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DASA-1800-VI

DEPARTMENT OF DEFENSE LAND FALLOUT PREDICTION SYSTEM

Volume VI
OUTPUT PROCESSOR

DASA • NDL • NRDL • TECH OPS

DASA-1800-VI

DEPARTMENT OF DEFENSE
LAND FALLOUT PREDICTION SYSTEM

Volume VI - Output Processor

TO-B 66-48

20 February 1967

Prepared By

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This research has been sponsored by the
Defense Atomic Support Agency
under NWER Subtask A7a/10.058

Submitted to

U.S. Army Nuclear Defense Laboratory
Edgewood Arsenal, Maryland

ACKNOWLEDGMENTS

The development of the Output Processor for the Department of Defense Land Fallout Prediction System was funded by the Defense Atomic Support Agency under Subtask A7a/10.058 through Contract DA 18-035-AMC-737(A) with the Nuclear Defense Laboratory. The authors gratefully acknowledge the contributions of Mr. R. C. Tompkins of the Nuclear Defense Laboratory.

ABSTRACT

The Output Processor Module of the Department of Defense Land Fallout Prediction System is described and instructions are given for its use. Working in close liaison with the Particle Activity Module (Volume V), the Output Processor converts the output of the Transport Module into a variety of displays in a directly contourable numerical (map) form by means of the off-line printer. It requires only two sets of input data in addition to the inputs called for by the Particle Activity Module: (1) a magnetic tape containing descriptions of sets of grounded fallout particles — an input from the Transport Module, and (2) card inputs by which the user may request any number of processing tasks to be carried out on the grounded fallout particle data. In each request any of sixteen distinct types of processing may be specified leading to the display of maps of any of the following quantities: (1) exposure rate "normalized" to H + 1 hour; (2) exposure rate at time H + T1 hours; (3) integrated exposure, H + T1 to infinity, accounting for time of arrival; (4) integrated exposure, H + T1 to H + T2, accounting for time of arrival; (5) fallout mass (per unit area); (6) fallout mass (per unit area) deposited between times H + T1 and H + T2; (7) integrated exposure, H + T1 to H + T2, assuming all particles have arrived by H + T1 hours; (8) same as 7 but integrated to infinity; (9) concentration of an individual mass chain (curies/m^2); (10) time of arrival; (11) time of cessation; (12) smallest particle deposited; (13) largest particle deposited; (14) mass deposited by particles in the size range S1 to S2; (15) H + 1 hour "normalized" exposure rate resulting from particles in the size range S1 to S2; and (16) the number of cloud (model) subdivisions affecting each map grid point. The user is free to specify any limiting coordinates and scale factors for the map display that will be produced and can also cause the resulting map, or maps, to be recorded on magnetic tape for further processing.

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INTRODUCTION

This volume is intended to fulfill two needs: (1) to provide information to the person who is interested only in understanding the Output Processor or in using it as it is; and (2) to provide a more detailed explanation of the programs and their functions to the researcher or programmer who would make modifications or additions. The sections entitled "Program Description," "Illustration of Output Processor Use," and "User Information" are intended to fulfill the first need; the section "Program Details," the second need.

PROGRAM DESCRIPTION

The Basic Operation of the Output Processor

The Output Processor of the DOD Land Fallout Prediction System is a very flexible, highly modular computer program for use in the interpretation of data representing grounded subdivisions of the radioactive cloud. In simplest terms, it is the task of the Output Processor to accept descriptions of grounded cloud subdivisions, make requests for particle activities or mass chain concentrations from the Particle Activity Module, interpret them into a two-dimensional memory array or map image, and then print the resulting array in a form suitable for viewing as a map. The processes originally required of the Output Processor were the computation of (1) exposure rate "normalized"* to H + 1 hour, (2) exposure rate at a specified time, (3) exposure accumulated between two specified times, (4) particle mass deposited per unit area, and (5) concentration of a user specified mass chain. In certain of these processes the time of particle arrival on the fallout field was also to be accounted for.

*Exposure rate patterns "normalized" to H + 1 hour are intended to show the exposure rates that would exist on the fallout field one hour after detonation if all radioactive particles that ever land on the fallout field were located in their places of deposit at that time. Obviously this differs from the exposure rate pattern predicted to exist one hour after detonation, since in actual exposure rate prediction we must account for the times at which particles arrive on or near the ground.

The following statements of requirement and intent describe some of our initial motivations and justifications for the approach which was followed in the construction of the Output Processor:

1. Great flexibility in program use should be allowed both in terms of the nature of computations and tasks and in terms of the degree of precision in both modeling and display.

2. The Output Processor should be capable of handling a large set of grounded particle data. The size of this set might vastly exceed available memory space. Thus an open-ended philosophy was adopted for the treatment of data on grounded particles.

3. The position and scale factor of the map should be under the direct control of the researcher. This gives the user or researcher the ability to produce maps of any desired scale factor for superposition on other maps and enables him to achieve either a microscopic or a macroscopic view of the predicted fallout field.

4. The Output Processor should be capable of handling output maps containing a larger number of map grid points than can be represented in the computer memory at one time. This led us to an open-endedness in output map size.

5. In computing exposure rates at arbitrarily specified times, it is deemed of great importance to avoid reliance on a single exponential decay constant (such as - 1.2) which is truly applicable only to a mixture of unfractionated fission products — not in general to isolated samples of fallout such as those that appear locally in fallout fields. Therefore, the Output Processor Module should be built to work in close liaison with the Particle Activity Module so that particle activities can be computed directly from the primary mass chain data for (deposited) particles at the particular time or times specified in each output request. Furthermore, by means of this approach it should be possible to compute and display concentrations of any (user) specified mass chain.

6. With regard to display of the fallout map data produced by the Output Processor we are faced with somewhat conflicting requirements: (1) we desire a numerical display of the data rather than some sort of purely pictorial or graphical display because of the intended research application of the system, whereas (2) an automated pictorial or graphical display relieves the researcher of the time consuming and tedious task of transferring numerical data to a grid and hand contouring isoexposure lines. The display actually provided is a compromise between these two extremes. A numerical display is provided; however, it is in a format that allows strips of the printed computer output to be attached side-by-side so that the entire fallout prediction area is included on the assembled paper. Thus, the printed numbers represent exposure rate (or some other output) predicted for each of the points of a regular grid that can be arranged to be spatially undistorted, and the resulting map can be easily contoured directly on the printer output paper. The major disadvantage of this type of display is the large size of the maps produced.

7. In general, it was desired that the Output Processor be simple to use and be reasonably foolproof and automatic with respect to its internal operations. Since the sizes of input and output data sets were assumed to be widely varying, this led us to a certain amount of essentially "dimension free" programming with the objective of making it unnecessary in most situations for the user to explicitly modify memory allocations (dimension statements) and recompile programs in order to change the program's scale of operation.

Flexibility of the Output Processor

For a research system — one which is capable of aiding the researcher in his many and varied tasks — no single approach to flexibility is sufficient and, consequently, we have designed the Output Processor with three modes of flexibility in mind: (1) program modularity; (2) parameter controlled options; and (3), as a midground between these two, code insertion points.

First, functional subroutines have been designed to operate wherever functions could be clearly seen. For example, within the Output Processor there are a subroutine (CALC) with the primary function of interpreting ground cloud subdivisions into a two-dimensional array, and a separate subroutine (MAP) with the function of composing and displaying the computational results. These functional subroutines may be relatively easily replaced by other subroutines having similar purposes. As an example of the second mode of flexibility, in CALC all currently required computational tasks have been accounted for and these computational alternatives are treated as parameter-controlled options within the program. In order to select one of the available computational options, the user need only punch on an input card the appropriate numerical value for an input parameter, in this case the parameter NREQ. Furthermore, provision has been made in the CALC option selection procedure (as well as in those of other programs) for the future inclusion of other computational option codes with little or no modification to the control programming within the subroutine. Such insertion points (noted in the flow charts and card listings) represent the third mode of program flexibility.

Inputs to the Output Processor

The primary input to the Output Processor is the magnetic tape of grounded particle descriptions which is produced by the Transport Program. For each included central particle (representing a cloud subdivision) this tape contains the two horizontal coordinates of its impact point, its time of impact, the central particle size, and a mass per horizontal unit area covered by the cloud subdivision. In addition, this tape contains a tabulation of particle properties (mass and surface/volume ratio) as a function of particle size range.

In addition to this primary input the user must communicate to the program his wishes regarding the kind of output computation and its form of presentation. He must also provide run identification information and information on certain important computer features. The run identifier is an arbitrary 72 character statement which the user can set to identify and associate outputs and inputs. The other inputs are needed to allow the program to adapt to some degree to different computer environments.

The following algebraic sentence summarizes the operation of the Output Processor:

Particle impact data

+ available tapes and printer characteristics

+ map characteristics

+ computation option specification

+ display option specification

$\Rightarrow$ desired presentation.

By available tapes we mean simply the identifiers of magnetic tape units that are available for temporary use by the Output Processor. The printer characteristics are the character spacing constants for the off-line printer. The map characteristics are, at this time, the description of the geographical limits and data point density of the map which is to be produced as output. By computation option we mean the choice of one of the many alternative output quantities to be computed and displayed. By display option we mean the choice of a particular printed map format; perhaps in the future it could also specify a format for another kind of output device.

Available Options for Computation and Display

The following is a listing and brief discussion of the major options for computation and display which exist in the Output Processor. An exhaustive list of all currently available options is provided in the section entitled "User Information."

1. Printed descriptions of impacted particles

   Under this option the content of the grounded particles tape may be printed in a form analogous to that in which it exists on the transport tape (IPOUT). This option is valuable in checking the execution of experimental transport codes, and it is also useful in providing a hard and readable copy of the result of transport production runs.

2. Computational options

The descriptions below apply to each point of the map grid.

a. Count of grounded cloud subdivisions. This optional computation was of primary value in debugging the Output Processor but may also be of considerable value to the researcher in assessing the statistical validity of a computed map quantity at any particular point on the map.

b. Exposure rate "normalized" to time H + 1 hour. This is the recognized standard mathematical construct for the comparison of fallout patterns. It should be noted that differences may exist between DELFIC H + 1 hour normalizations and those resulting directly, or indirectly, from backward extrapolations of field data — in backward extrapolations one decay constant is usually used, whereas DELFIC provides a more rigorous modeling of radioactive decay.

c. Exposure rate at time H + T1. This is actually the exposure rate at the specified time taking into account the impact times of all cloud subdivisions.

d. Exposure accumulated from time H + T1 to infinity. This is the exposure as integrated from time H + T1 or particle impact time, whichever is later, for each impacted particle.

e. Exposure accumulated from time H + T1 to time H + T2. This is the exposure as integrated from time H + T1 or particle impact time (whichever is later) to time H + T2. A faster alternative treatment of accumulated exposure not accounting for particle impact time is also provided.

f. Total mass deposited. This is the mass of fallout, both radioactive and inert, deposited on the map grid points during the entire fallout period.

g. Total mass deposited between times T1 and T2. This is the total mass, both active and inert, deposited during the specified interval.

h. Activity produced by a user specified mass chain (curies/m^2).

3. <u>The undistorted map option</u>

A number of different options exist with regard to the scaling of output maps. As stated previously (p. 3), it is possible for the Output Processor to provide a numerical presentation of the fallout data on a spatially undistorted grid. In achieving this the user is assisted by the program. However, he must supply the printer characteristics (characters/inch both horizontally and vertically) and must specify that the "undistorted map option" is to be exercised. Then the program determines appropriate grid spacings to accommodate the printer characteristics. On the other hand, the user may specify the grid intervals and in so doing he can obtain any rectangular spatial distortion he desires Also, he may allow the program to make small adjustments to the specified grid intervals to achieve a faster running program if an undistorted map is not a requirement. In any case, an overall scale factor for the map must be specified.

4. <u>Numerical display options</u>

Two options exist at this time for printing the numerical values of the fallout data over the grid points. These options, which can be characterized as the two-line E format and the two-line F 11.3 format, are explained and illustrated, as follows, for a single data point:

a. The two-line E format,

```
NNNNNN
      ±V.VVV ,
```

which is to be interpreted as

$$\pm V.VVV \times 10^{NNNNNN}$$

b. The two-line F 11.3 format,

```
NNNNNN
      ±V.VVV ,
```

which is to be interpreted as

±NNNNNNV.VVV .

In both of these display options the decimal point indicates the map location of the grid point.

In addition to the two options for printing numerical values, a third option exists which allows a numerical map image to be recorded on a magnetic tape referred to as the multiple burst tape. Matched pairs of multiple burst tapes may be processed by a separate program (see Volume VII of this documentation) to form printed or tape recorded maps of the point-by-point sums, differences, products, or quotients resulting from map superposition.

Sequences of Processing Requests

The Output Processor has been arranged to accept as input a sequence of requests for processing. This was deemed appropriate because of the large number of different quantities which might be of interest to the researcher now, and also after further development of the program, and because of the usual turn-around time delays which plague the users of computer centers operating with a batch processing system. Rather than handling requests on a one-per-run basis, unlimited sequences of requests are accepted. Thus, the program is open-ended with respect to requests on a given grounded-particles data set.

The control programming of the Output Processor is designed to allow any number of maps to be prepared for each of any number of different map limits. Suppose the user desires sets of maps to be prepared separately for each of two different sets of map limits. For example, the user may desire large-scale maps of essentially the entire local fallout field for (1) exposure rate normalized to H + 1 hour, (2) total accumulated exposure, and (3) activity from mass chain 95. He may also desire the same map options for a physically larger map covering a geographically smaller area closer-in to ground zero. To accomplish this he can specify the map limits and scale factor for the large-scale map and follow it by the needed map option request cards. These data would be followed in turn by the other map limit specifications and another series of map option request cards.

Output Processing Independent of Other DELFIC Modules

In its primary role the Output Processor acts as the terminal portion of the main body of the DELFIC system; yet, since it consists of control programs and

a set of subroutines, it can also operate independently of the other programs of the DELFIC system except for the Particle Activity Module. (See the section on "Inputs to the Output Processor," p. 4.) This feature can be used to advantage if the user saves the magnetic tape results of the transport program's execution. In this way the user need not specify all desired output at the time of the transport execution but can make subsequent runs of the Output Processor as specific questions arise during the course of his research. The tape and card inputs to the Output Processor are the same, no matter which way the program is used.

General Logic of the Output Processor

In this section we present a general description of the logic of the Output Processor including general or organizational flow charts. A more detailed description, which includes highly detailed flow charts of all subroutines and a complete discussion of the more involved subroutines, is given in the Program Details section. Particular emphasis is given to those programs which we feel individual users may desire to modify for the sake of adding new capabilities to the DELFIC system. Additional details are also provided in the Appendix, which defines the various arrays used by the Output Processor programs, and by the glossary of primary program variables which is included in the listing of the first control program, subroutine LINK8.

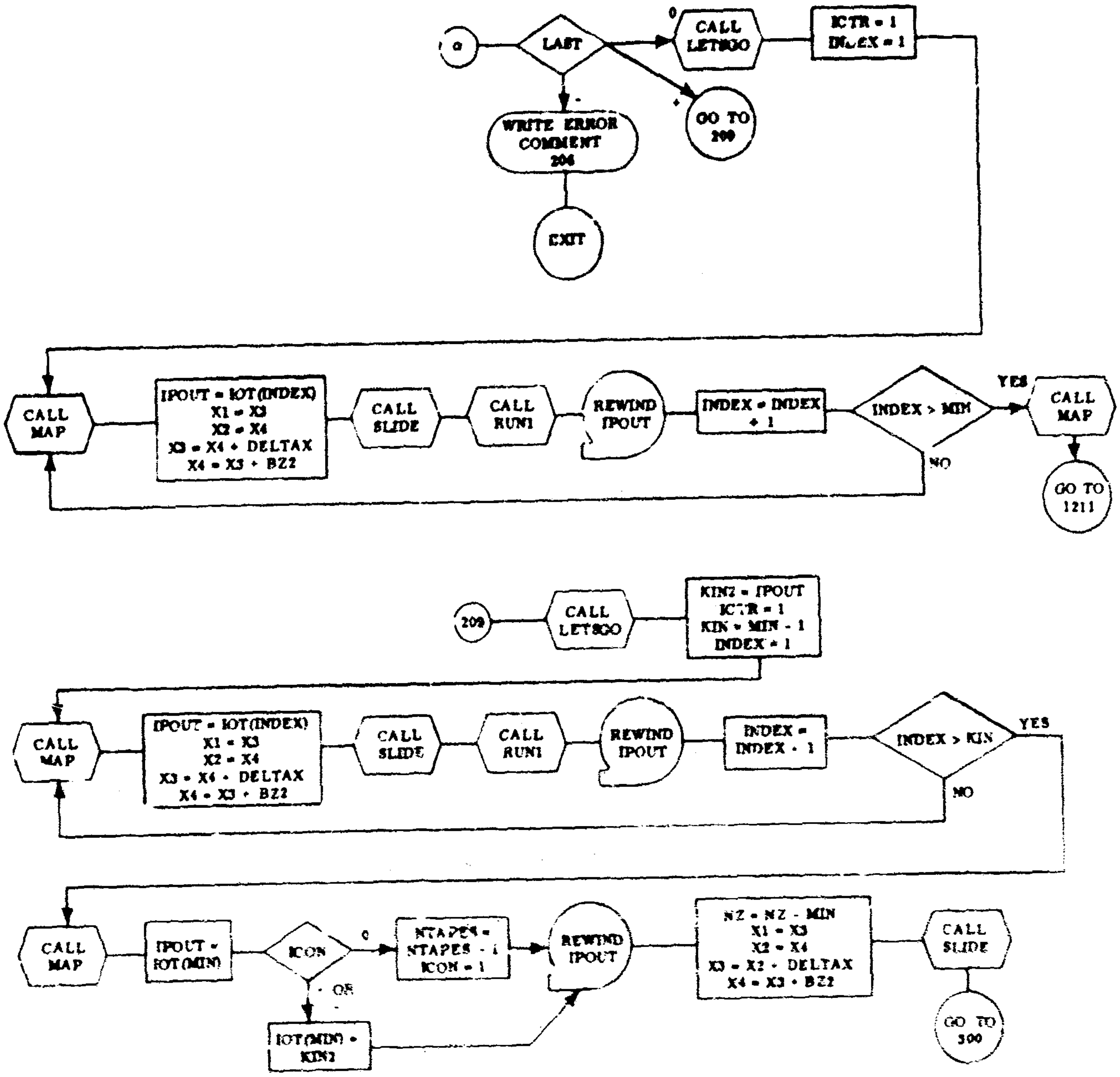
The Output Processor consists of two control programs and eleven subroutines (a brief statement of the purposes of these programs is set forth in Table 1). In addition, the Particle Activity Module subroutines PAM1 and PAM2 (see Volume V of this documentation) are called within the Output Processor. It should be noted that subroutine PAM1 requires certain card and/or tape inputs to be available during the execution of the Output Processor.

Flow chart FC-1 gives a simplified picture of the logic of the control programs, LINK8 and LINK9, and is a suitable point of departure for the reader who wishes to understand the Output Processor in depth. In the topmost diamond box of the flow chart we note that one of the optional features of the Output Processor allows the user to have the content of the grounded particles tape printed, and have the processing terminated upon completion of this or continued as specified. Following downward one can see the hierarchical nature of the map limits specification loop which begins with the reading of the coordinate limits of a map, and the map request

TABLE 1

OUTPUT PROCESSOR PROGRAM SYNOPSIS

Program Name	Purpose
LINK8	Initialization and liaison with subroutine PAM1 (Particle Activity Module) and LINK9.
LINK9	Interpret grounded particles into the output map array and call PAM2 (Particle Activity Module) for particle activities or mass chain concentrations.
CALC	Interpret grounded particles into the map array.
COUNT	Select the largest sorted data set for dumping onto memory tape.
CRDP	Subordinate control routine which calls SHIFT to clear out most of the particles array after a pass of the data tape has been completed.
DIFUZ1	Expand cloud subdivision areas to account for diffusion.
LETSGO	Control routine for the situation in which sorting onto tape is required.
MAP	Display the Output (Print the Map).
PROC	Subordinate control routine which eliminates unneeded particles, sorts and counts other particles, and calls CALC to interpret those falling within the current map area.
RUN1	Control routine for the situation in which no data sorting onto tape is required.
SHIFT	Collect a selected set of particle descriptions and write them onto memory tape.
SLIDE	Slide the content of the right buffer zone over to the left zone in preparation for processing the next map zone.
ZERO	Collect blank lines at the top of the particles arrays in preparation for reading in more particle descriptions.



FC-1. Organization Flow Chart of the Output Processor

loop which begins with the reading of a computation request (see the Sequences of Processing Requests section on p. 8). It should be noted that, in order to bring about a final program exit, the program must encounter a blank card (image) to terminate the map request loop, and then another blank card to terminate the map limit specification loop. Most of the program's complexities are found within the two lowest boxes of FC-1 and, consequently, the remainder of this discussion will be devoted to them.

The user of the Output Processor must specify the area that he wishes to be mapped by indicating its limiting coordinates. This area is rectangular with its sides aligned north-south and east-west. The positive Y direction points north and the positive X direction points east. Grounded cloud subdivisions are represented on the data tape by the impact coordinates of one central particle for each subdivision. The shape of each cloud subdivision is a square and the length of the side of this square at subdivision definition time is communicated to the Output Processor by the transport program via the parameter BZ on the grounded particles tape. Since central particles which fall within the distance, BZ/2, from the edge of the specified map limits will affect the map area, we must consider all particles falling within a rectangle which includes a margin of width BZ/2 on each side of the map. Figure 1 indicates both the map specified by the user (heavy rectangle) and the area of computational interest (the light rectangle surrounding the heavy one). Note that the symbology of Figure 1 corresponds to that of the FORTRAN programs.

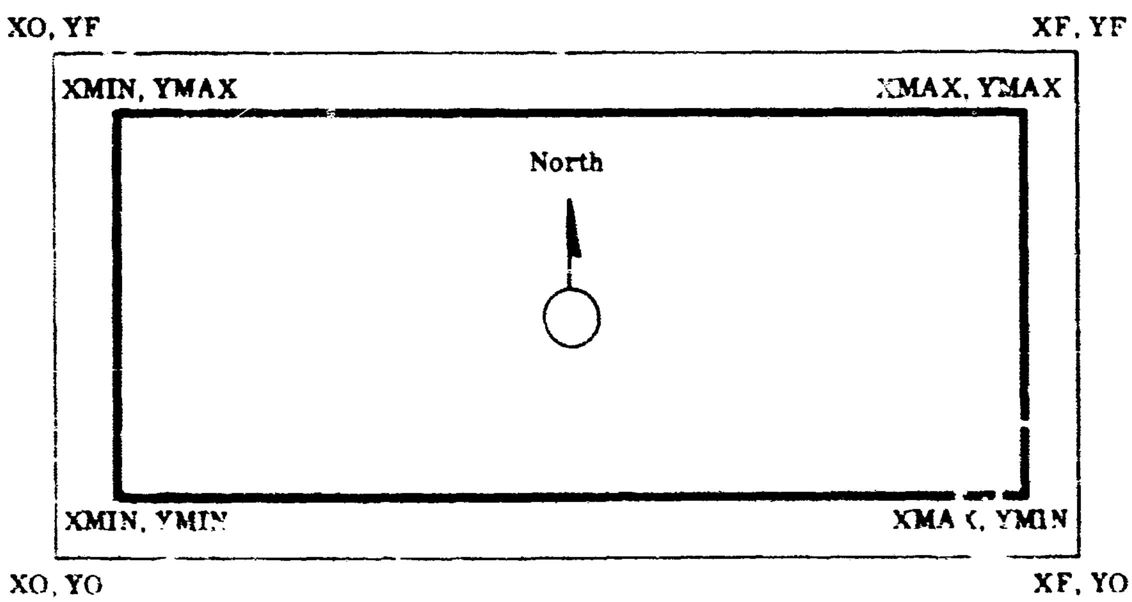


Figure 1. The Map Area Without Subdivision

The overall map area is subdivided into a grid according to the grid intervals specified by the user (as modified by the program if the undistorted map option is specified (see p. 7)). If the grid intervals specified by the user are such that the data for the entire map can be contained completely in the core storage map array, no further subdivision of the map area need be made. This is the situation represented by Figure 1. On the other hand, if either smaller grid intervals or a larger map (or both) are specified, the number of grid points in the complete map may be too large to fit in the map array at one time. In this situation subdivision of the kind shown in Figure 2 may be required. This type of subdividing is done automatically by the program without any guidance from the user. The shaded strips in Figure 2 represent buffer zones between map areas which must be used since cloud subdivisions falling near the boundary between map zones could otherwise affect more than one zone.* The region marked "Zone 1" will be treated as a first map and any particles falling into (or near) this zone will be immediately interpreted into the map array. Particles falling in the other marked zones (Zone 2, Zone 3, etc.) will be eventually written onto zone memory tapes for later interpretation into the map. However, since particles falling into the buffer zones affect more than one map area, they must be written onto more than one tape. The tape memory assignments of areas are indicated in Figure 2 by the overlapping arrows marked "Tape 1," "Tape 2," and "Tape 3." In the situation represented in this figure there will be, after the first map area is printed, effectively a one-to-one correspondence between subsequent map zones and tape memory data sources. A slight exception to this statement is brought about by the need to keep the right-hand buffer zone map area in the map array to account for the effect of Zone N particles on Zone N + 1.

Figure 2 also illustrates the meaning of the program variables X1, X2, X3, and X4 for the processing of the second map zone. X1, X2, X3, and X4 denote respectively the X coordinates of the left side of the left buffer zone, the right side of the left buffer zone, the left side of the right buffer zone, and the right side of the right buffer zone. These variables are set by the program prior to the start of processing on a new map zone. DELTAX, which is also illustrated, is a constant set the program on the basis of the required map dimensions and the size of the available map array.

*Buffer zones and map zones should not be confused with the printer strips into which a map zone is actually divided for printing and subsequent assembly. The maximum width of printer strips is fixed by the number of characters that the printer can print on one line.

If there were, for example, only two tapes available for sorting instead of the three illustrated in Figure 2, it would be necessary to use a tape as an overflow memory. In this situation the particles falling into Zones 3 and 4 would be written onto the overflow tape, and after the interpretation of the data on Tape 1, the program would return to re-sort the data on the overflow tape. The use of this overflow tape memory effectively makes the program entirely open-ended in regard to the size of the maps it can produce. At the same time the use of tape memory, when (but only when) it is required, should tend to make the program acceptably efficient for smaller tasks.

It is important to note that the "zones" depicted in Figure 2 should not be confused with the strips of printer paper that are attached side-by-side for direct contouring. (See the discussion on p. 16.) The number of paper strips produced is determined by the interrelation of the number of data points, the grid interval in the X direction, and the width of the printer line. In general there will be more than one strip for each zone.

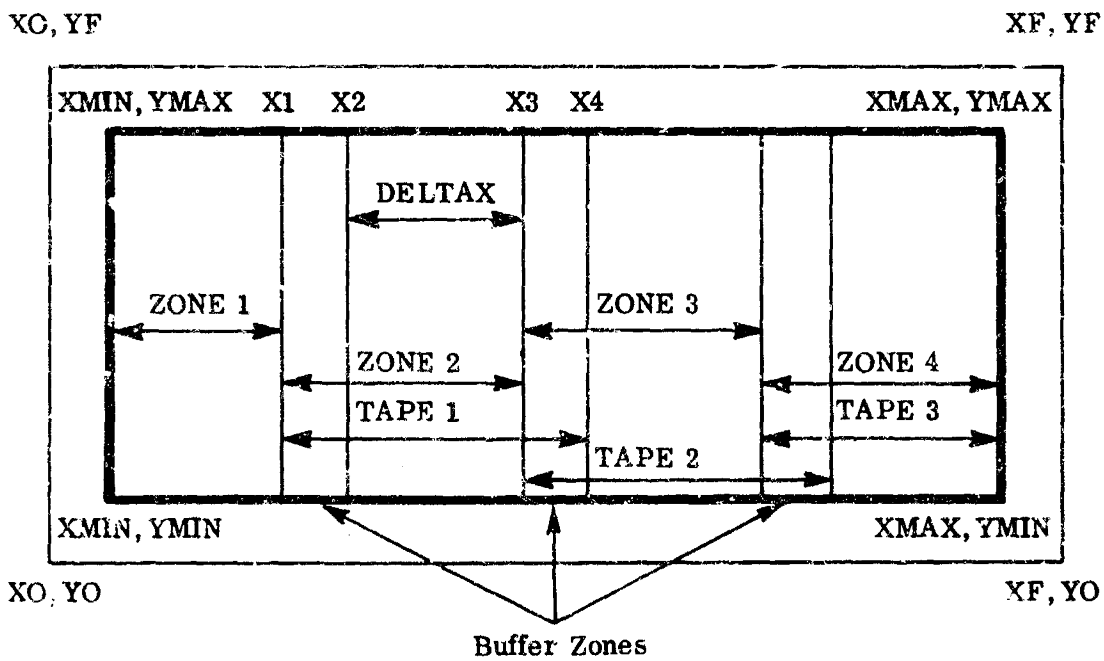


Figure 2. Map Area With Subdivision

AN ILLUSTRATION OF OUTPUT PROCESSOR USE

For the sake of illustration, let us assume that you as a researcher are preparing to make use of the Output Processor. How should you start and what should your strategy be?

It is suggested that the first things to be done in an unfamiliar prediction situation are to have the Output Processor print a hard copy of the grounded particles tape, and in addition, to call for a large-scale map to provide an overview of the fallout field. Both of these tasks can be carried out in the execution run that does the transporting. The grounded particles tape produced by the Transport Module and used by the Output Processor in the initial run may be saved and reused in subsequent runs of the Output Processor and Particle Activity Modules to produce any additional maps desired. In order to specify the first set of tasks the user must set about a dozen control parameter values. One parameter (IC(18) > 0, p. 49) causes the grounded particles tape to be printed. Another (IC(17) = 0, p. 49) causes processing to continue after that printing has been finished. Four others (XMIN, XMAX, YMIN, YMAX, p. 49) give the coordinate limits of the desired map. Two others (DGX and DGY) give the map point grid intervals in the X and Y directions. One other specifies that the map should be, for example, a map of exposure rate "normalized" to H + 1 hour (NREQ = 2, p. 51).

In the second and subsequent execution runs after the printed list of grounded particles and the large-scale map have become available, the user may request that any number of more detailed maps be printed. These larger and more precise maps can, of course, portray any of the possible output quantities of the DELFIC system.

Figure 3 illustrates how a user may arrange his requested map areas and scale factors to expose prediction details of interest to him. Area coverages and map dimensions shown are merely illustrations and in no sense are meant to imply any restrictions in the use of the Output Processor since their characteristics are completely under the control of the user. Map 1 is a large-scale overview that indicates the shape and location of the fallout field, but is necessarily crude because it is small in actual size (2 x 2 ft) and thus contains a small number of points. Maps 2, 3, and 4 represent much more precisely the predicted fallout field within 10 miles of ground zero. They are, for example, 6 x 6 ft in size and contain nine times as many data points as the overview (Map 1), but represent an area of the fallout field less than one tenth as large as the overview. They may, for instance, portray predictions of mass deposition,

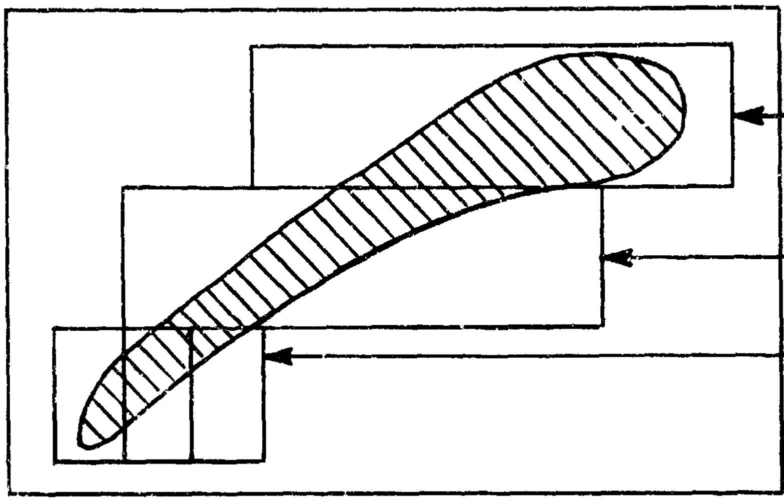


Figure 3. Map Coverage Example

exposure rate at H + 2 hours, and the concentration of mass chain 89. Maps 5 and 6 continue the representation of mass deposition but do so with less precision than that of Map 2 since they are about 4 ft long and cover larger fallout areas.

The task of arranging the card inputs to the Output Processor is not a complex one, but it does require that the user make certain decisions about what he wishes to have portrayed and how he wants it to be portrayed. He should know what coordinates were used to identify the location of ground zero within the transport module. He should know that all distances (coordinates) are measured in meters from the same coordinate origin. He should have at least a rough idea of the direction of the winds. Beyond that, he need only know which of the display options he wants to have portrayed. A card-by-card and parameter-by-parameter explanation of the input card deck for the Output Processor is given in the User Information section.

The map produced by the Output Processor will consist of a sequence of numbered "strips" of printer paper that can be detached at the boundaries between successive strips and assembled side-by-side into a single map of the overall area covered by the specified map limits. When so assembled (the strips are numbered in sequence from left to right) and hung on the wall for viewing, the data point with minimum X and minimum Y coordinates will be found in the lower left hand corner of the map (i.e., the lower left hand corner of strip number one). The coordinates of this point will be (XMIN + DGX, YMIN + DGY). This point need not be either the origin of coordinates or ground zero.

PROGRAM DETAILS

Control Program LINK8 (FC-2)

The purpose of LINK8 is to (1) initialize the Output Processor system, (2) print out an impacted particle list, and (3) call PAM1 of the Particle Activity Module. (See Volume V of this documentation.)

Upon entrance, LINK8 first sets a number of program constants which denote such things as the logical identifiers of certain essential tapes and the maximum sizes of certain arrays. When installing the Output Processor at a new computation center or on a new computer system, it is essential that the system tape identifiers be checked to see that they conform to established requirements. Note, however, that changing the tape number assignments at the beginning of LINK8 will suffice for all programs of the Output Processor since all tape references have been made via established tape names, e.g., ISIN, ISOUT, IPOUT.

In a similar way, whenever it becomes possible to run the Output Processor on a computer that has a high speed memory larger than 32, 768 words, adjustments should be made to the sizes of certain arrays within the program. If a larger memory is available, the programs will, of course, function correctly without adjustment, but improved program efficiency can be easily attained if adjustments are made. If the program must be run in a smaller segment of memory than it now uses, only a few simple adjustments must be made in order to scale down the program, but program efficiency will necessarily suffer. The program array OMAP and the companion array size variable NMAP may, for instance, be adjusted downward (or upward) together to change the size of the usable map array. Changing the OMAP dimension statement, and the statement which sets the value of NMAP, is all that one needs to do since all usage of the map array is based on the parameter NMAP. Of course, the new size of the OMAP array as specified in the dimension statement and the value of NMAP should coincide, and all Output Processor programs should be recompiled (with adjustments made to all dimension card decks).

After parameter setting, LINK8 attempts to check the identification of the grounded particles tape, and if successful, it proceeds to read and record all previous identifier records that are on that tape. Next, particle size frequency

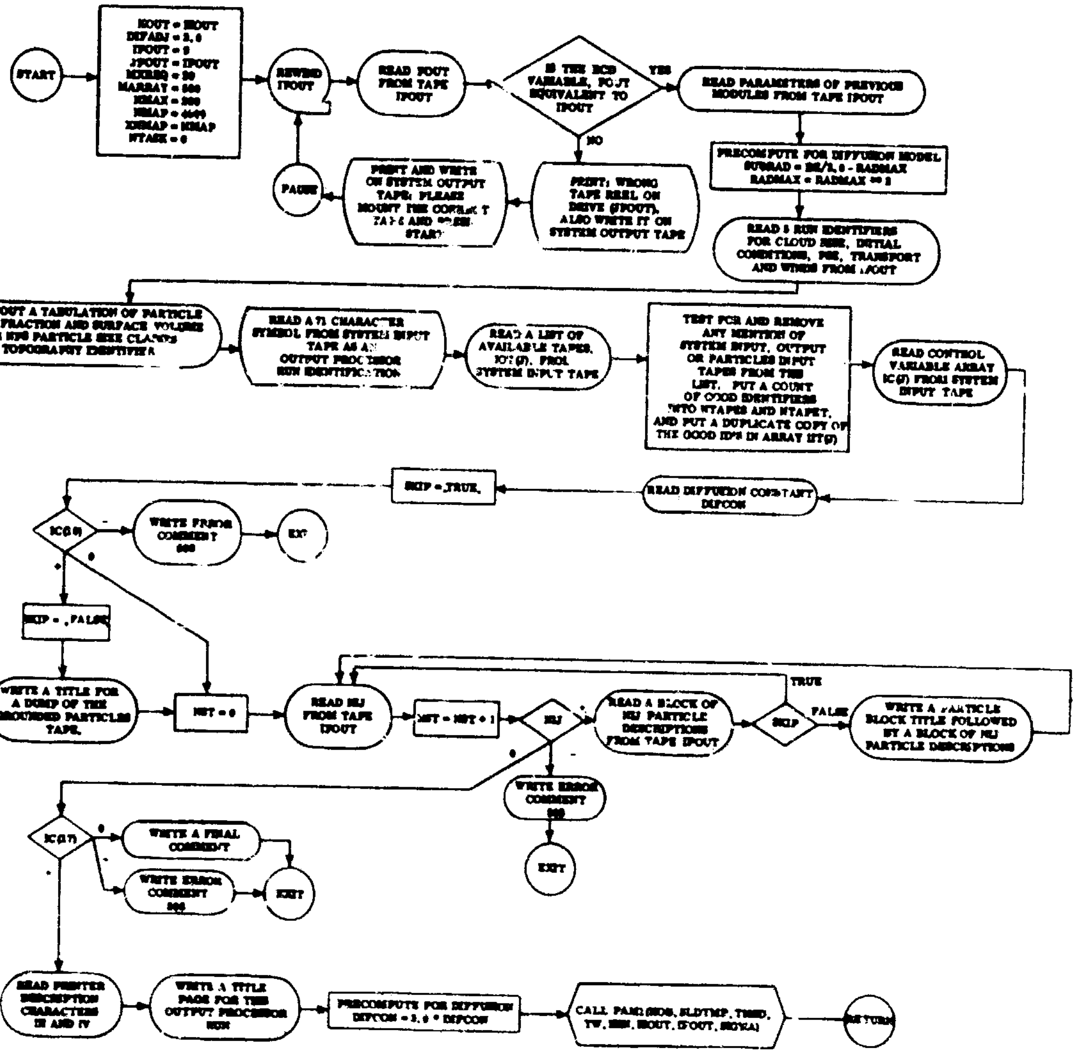
distribution data are read into memory from the grounded particles tape. This is followed by a list of identifiers of tapes available for use in sorting which is read from the system input tape. A partial check is then made to remove from this list any inadvertant references to system tapes or the grounded particles tape. A duplicate copy of the corrected list is stored in the array IIT(J) for eventual reconstruction of the entrance condition. Next, the overall control array IC(J) is read and a branch is made on the value of IC(18) which indicates whether or not a hard copy of the grounded particles tape is desired at this time. After producing a hard copy of the grounded particles tape, a test of IC(17) indicates whether or not further processing is desired, and if it is, the program execution proceeds to statement number 5111.

At statement 5111 printer character spacing data (IH and IV) are read and a title page is written onto the system output tape. Then control is passed to subroutine PAM1 of the Particle Activity Module where occurs: (1) sorting and editing of nuclear transitions and decay subchain data, (2) computation of Freiling F_R factors, and (3) computation of part 1 of the induced activity contribution. Upon return from PAM1, control is transferred to LINK9.

Control Program LINK9 (FC-3)

Under the control of program LINK9 of the Output Processor, output maps are prepared and printed and subroutine PAM2 of the Particle Activity Module is called as needed to compute particle activities or specific mass chain concentrations (see Volume V). At statement 119 a sum of map ordinates is printed if one was computed earlier. At statement 1191 a specification of the limiting coordinates, grid intervals, and surface roughness factor of a desired map are read. If the surface roughness factor is input as zero, it is set to 1.0. The sum of the grid intervals is tested for zero as a termination condition. This is the correct exit condition and leads to an on-line printer comment for the notification of the computer operators.

If acceptable grid intervals are specified, the local control array JC(J) is read, parameters are set for the processing request loop, and a test is made on the printer description parameters IV and IH.



FC-2. Main Program LINK8

Statement 1211 is a return point where a special terminal record is put onto the multiple burst tape if one is in use. At 1209 the sum of map coordinates is printed if it has not been printed previously. At statement 1219 we enter the processing request loop and read a request in the form NREQ, T1, T2, MASCHN. After input checking and loop initialization, a test is made on NREQ for the exit condition (NREQ = 0) which leads to a return to the processing loop at statement 119. If a valid request number is encountered, tape IPOUT is repositioned so that the next read statement can bring in grounded particle data; a request title page is written, and entrance parameters are set for both the Output Processor and subroutine PAM2. If JC(18) and JC(16) so indicate, an adjustment of grid intervals is made so that an undistorted map will be produced, but if an undistorted map is not required and small grid interval adjustments are permitted, a transfer to 1301 is made so that small adjustments can be made to the grid intervals to yield a more rapid program execution.

At statement 140 final grid intervals have been arrived at and the width of the buffer zones is set equal to the width of an integral number of grid intervals. Computations are then made of the numbers of grid points covered by the map in its two principal directions. NZ, the number of memory map zones, is also computed here. NZ is one less than the total number of zones into which the map must be divided so that it can be produced within the available map array. Next, NOX, the number of map grid intervals between buffer zones, and DELTAX, the distance between buffer zones, are computed for later use. Then, if grid interval adjustments were made, a record is made as part of the program's printed output.

At statement 1405 more initialization is performed. At 300, parameters MIN, JIN, and LAST are set on the basis of the number of available tape units. If NZ is zero, only one map area must be computed, i.e., all of the required map will fit within the map array at one time. Note that a single pass through RUN1 and MAP is required. Return is made to 1211 which leads to the reading of the next request. If NZ is positive but less than the number of tapes available, a single sorting pass followed by a sequence of single area interpretations is called for. Also, subroutine LETSGO is called to process the first map area and sort the remaining particle data onto available tapes. Then a loop which calls SLIDE, RUN1,

and MAP is executed to interpret the sorted data and complete the printed map. This time return is also made to 1211 for the next request. If NZ is greater than the number of available tapes, more than one sort pass is required. Again LETSGO interprets the first map area, sorts data for a number of other adjoining areas, and writes the remaining data onto a separate overflow tape for subsequent sorting. Return in this case is made to statement 300 so that a second sort of the overflow tape may be carried out. Eventually, a return for the next request will be made via one of the previously mentioned transfers to statement 1211.

<u>Subroutine CALC (FC-4)</u>

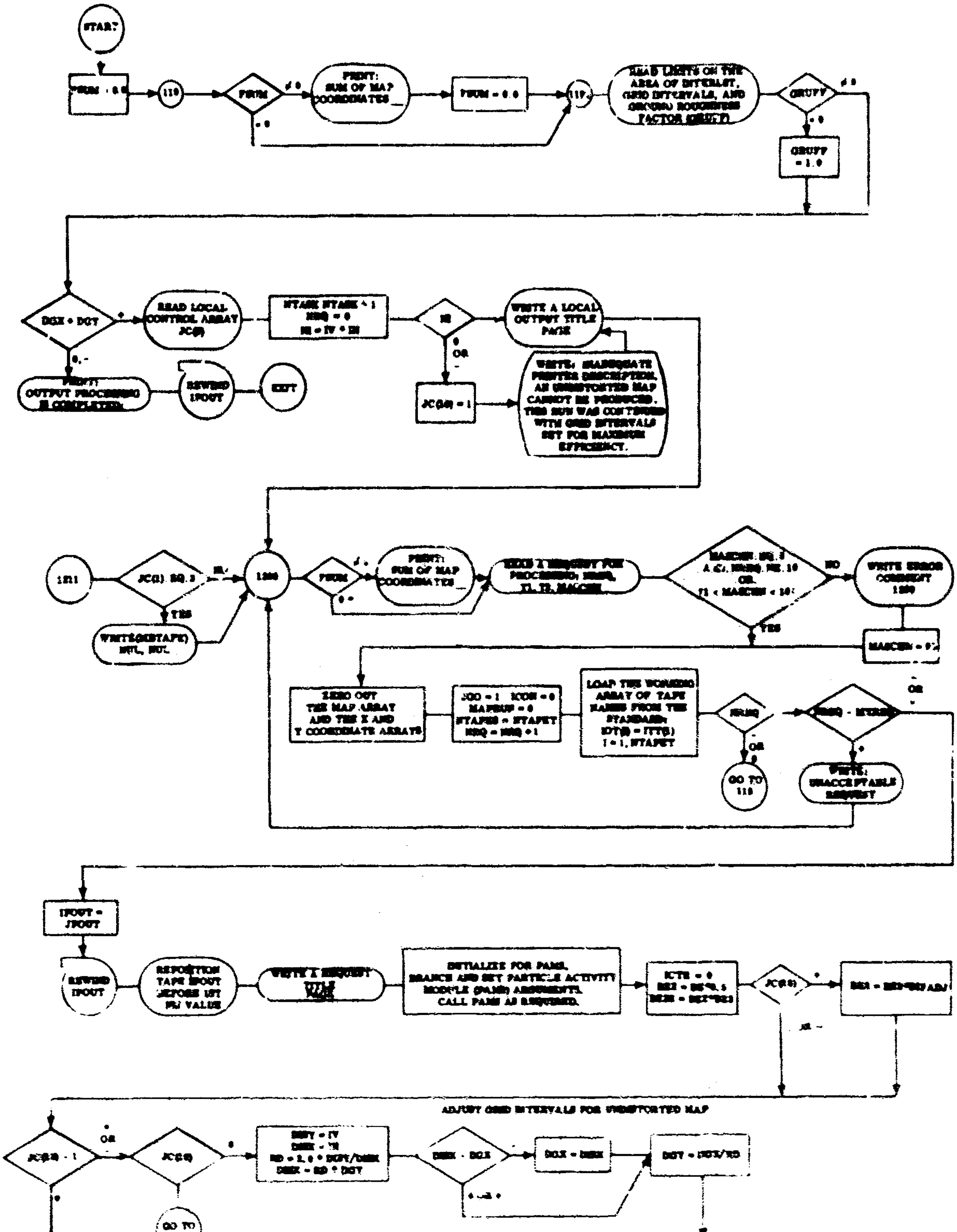
The purpose of this subroutine is to interpret a cloud subdivision into the map array OMAP. This interpretation consists of first the selection of the appropriate computation code which is shown on the flow chart as the branching operation based on the value of the parameter NREQ.

After the branch, a map ordinate increment is computed and stored in the variable F. Next, starting at statement number 100, CALC computes appropriate storage indices for the control of the program loops which actually carry out the map array incrementing operation.

Last the increment F is added to, or compared with, the content of the selected map array points by means of the two nested FORTRAN do loops starting just beyond statement number 19.

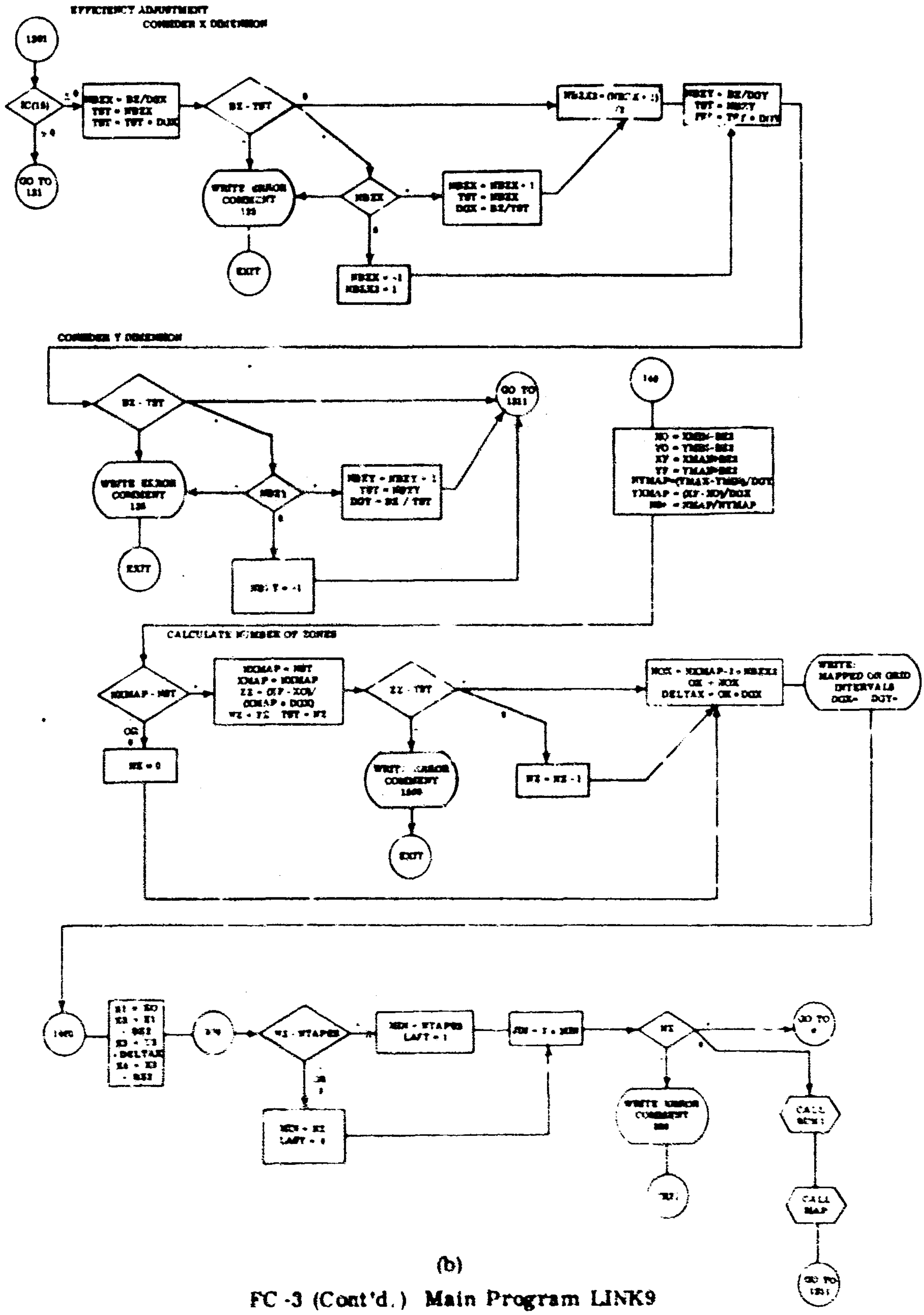
It should be noted that code insertion points have been provided within the computation selection branching operation so that new computational options may be easily added to the program. To insert the first new code one need only make sure that the code insert begins with statement number 109 and ends with the statement "Go to 100." The user must put the insert in the place of the card "109 CONTINUE" and then recompile subroutine CALC. Of course, the insert must not contain any statement numbers previously used within CALC.

Some explanation of the procedure used to compute the storage control indices is called for since this procedure is somewhat involved and very central to the Output Processor. As noted previously, the basic shape of the cloud subdivision in plan view is a square. The length of the side of this square is communicated to



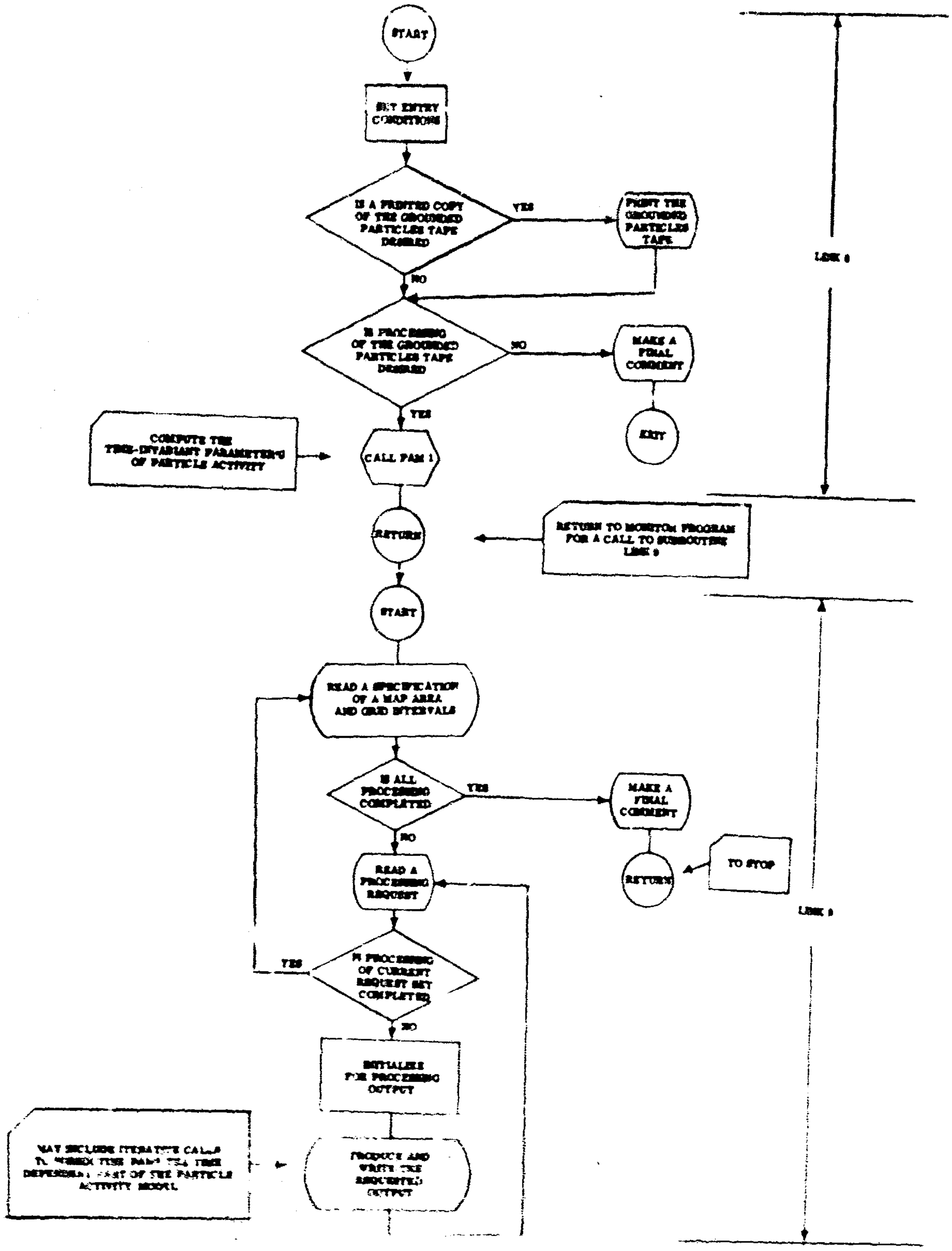
(a)

FC-3. Main Program LINK9



(b)

FC -3 (Cont'd.) Main Program LINK9



(c)

FC-3 (Cont'd.) Main Program LINK9

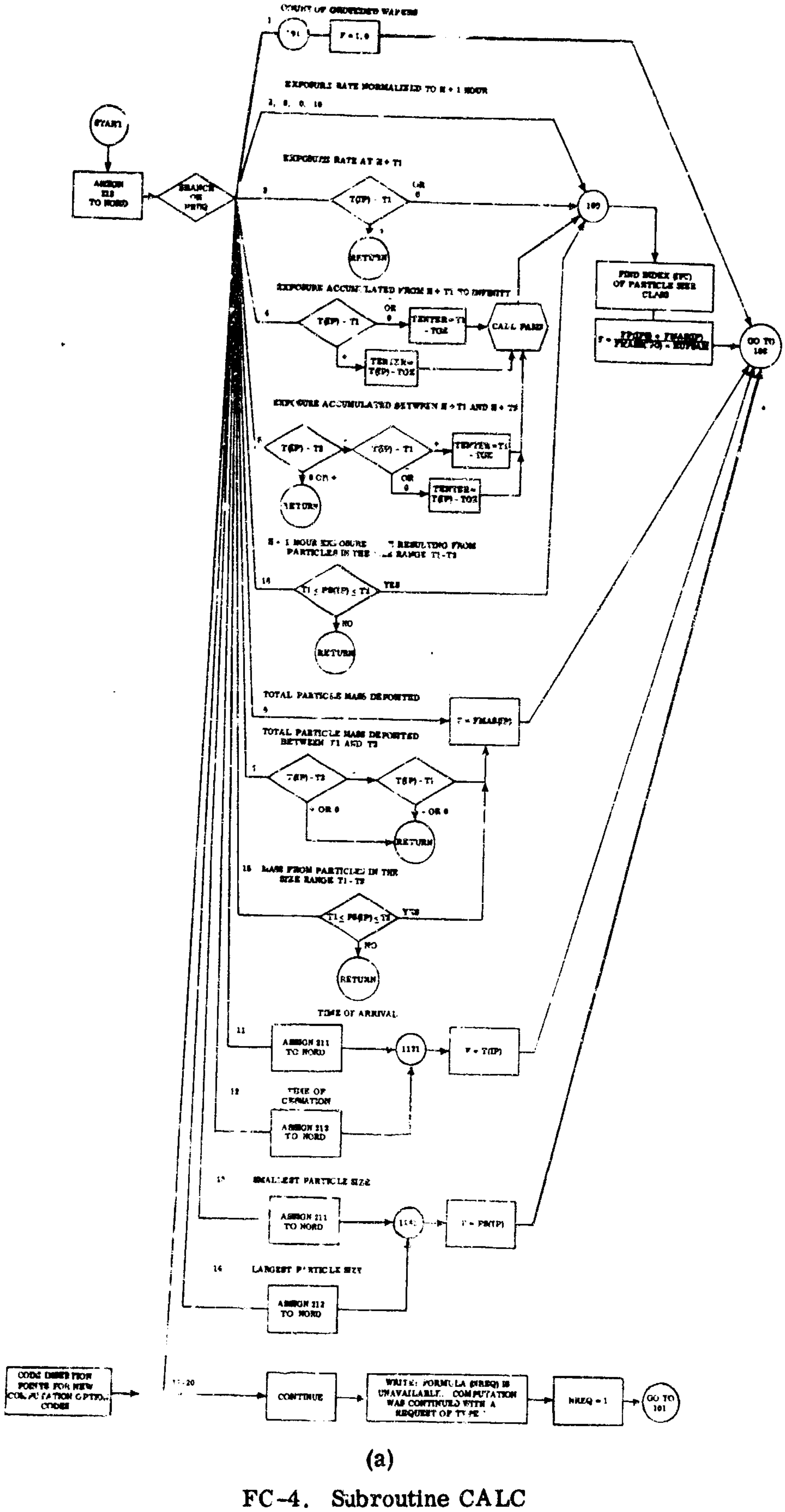
the Output Processor and to subroutine CALC in the parameter BZ. The procedure under discussion begins at statement number 100 with the calculation of the coordinates of the corners of the grounded cloud subdivision square. These coordinates are stored in the variables WXL, WXR, WYB, WYT. Any map grid point which lies within this square will have the quantity F added to its value. Next, the procedure computes NOL, the X index of the grid point which lies just to the right of the square's left boundary, and JX, the X index of the point which lies just to the right of the square's right boundary. NWX, the difference between these two indices, indicates how many grid points are to be incremented in the X direction. The result of this subtraction may be zero, in which case no grid point will be incremented by CALC. A similar treatment is given to the Y dimension, and the final set of results is stored in the variables NOL and NWX for the X direction, and NOB and NWY in the Y direction.

At statement number 19, loop control variables K, MM, and NN are computed in order to bridge the logical gap between the previously computed two-dimensional indices such as NOL and the one-dimensional array in which the map ordinates are really stored.

Certain complexities are added to the foregoing by the grid interval adjustment options which are available and by the need to correctly handle boundary-effects situations in which a cloud subdivision falls partially off the map area. The details of these treatments are provided by the program listings.

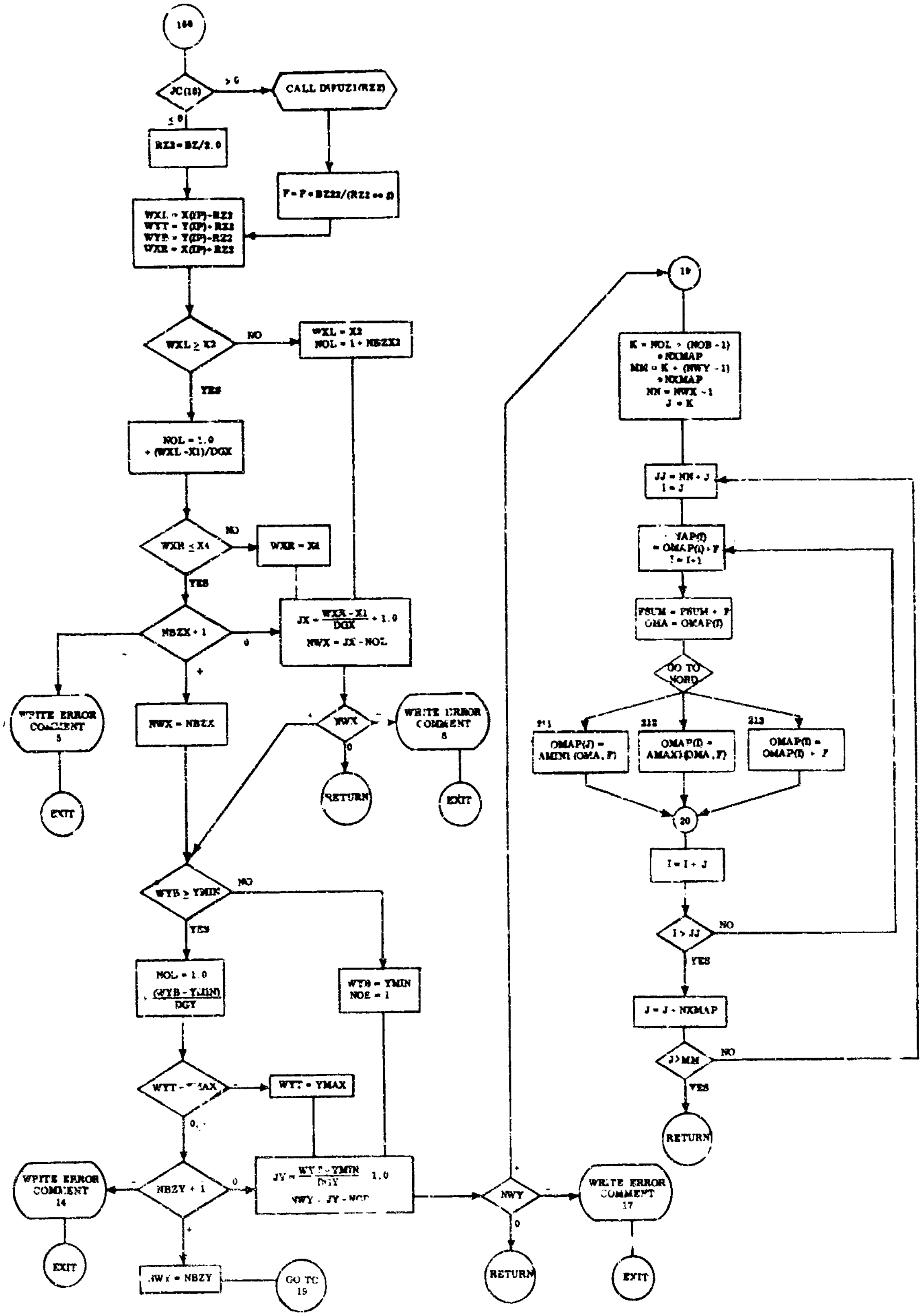
Subroutine COUNT (FC-5)

This subroutine selects the currently largest sorted and identified set of particle descriptions for dumping onto an external (tape) memory device. In making this selection use is made of the particle counter array, NP( ), in which NP(J) for even J contains the count of the number of cloud subdivision central particles that have fallen into the J/2th map zone (exclusive of adjoining buffer zones). The NP(J-1) and NP(J + 1) for even J contain the counts of central particles falling into the buffer zones to the left and right (west and east) of the Jth interbuffer map zone. In general, MAX(NP(J)) for even J represents the maximum number of particle descriptions that can be actually removed from the particle arrays by a single dumping operation.



(a)

FC-4. Subroutine CALC



(b)

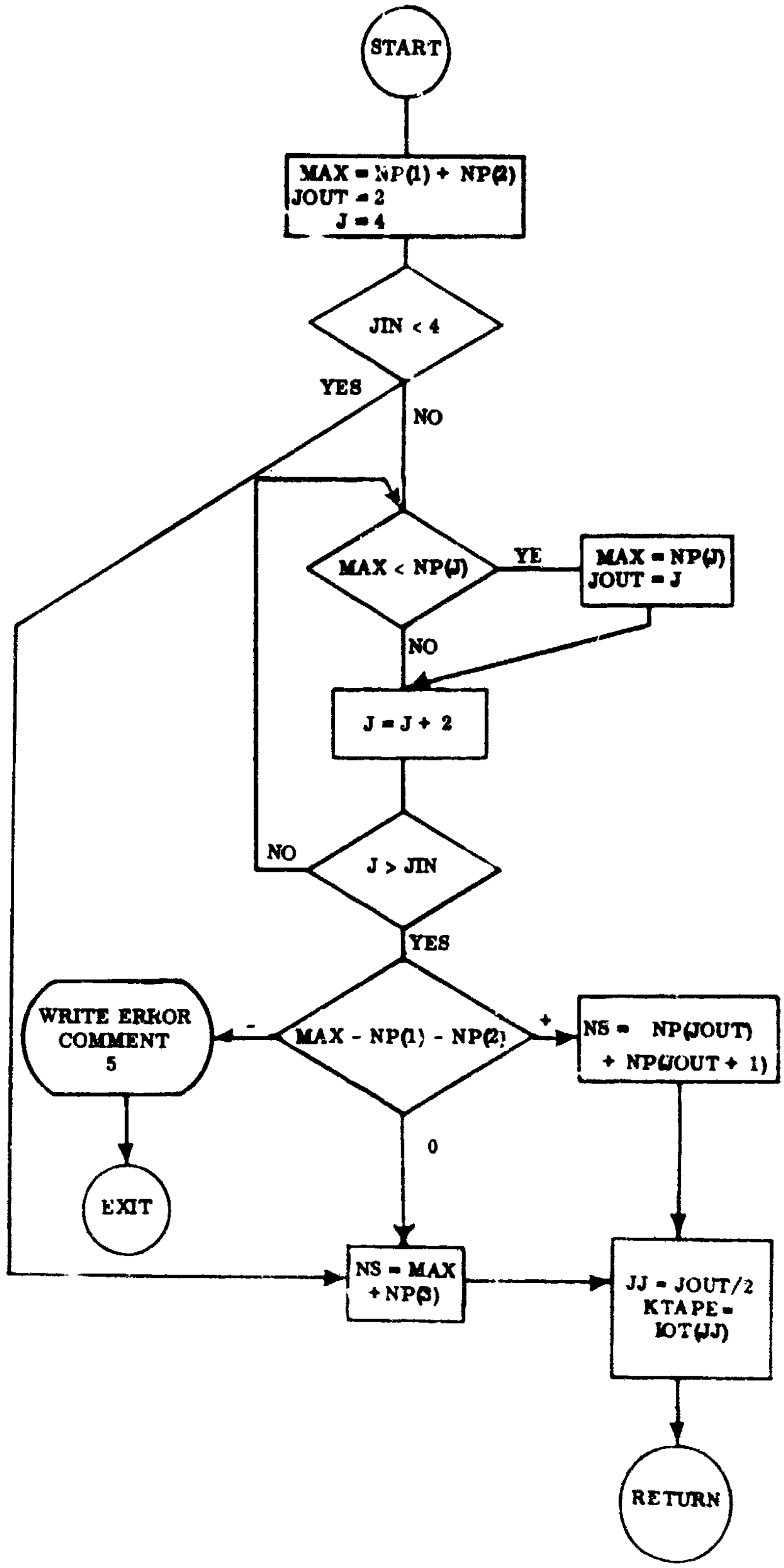
FC-4 (Cont'd.) Subroutine CALC

Since cloud subdivisions whose central particles fall into a buffer zone affect the two map zones on either side, it is necessary to dump buffer zone particles along with the particles from the surrounding map zones. However, buffer zone particle descriptions must also remain in memory, since they also affect some other map zone. (The subroutine shift reidentifies these duplicate particle descriptions by changing their classifications as recorded in the KTR( ) array in order to avoid double counting later.) In general, the number of particle descriptions which will actually be dumped onto memory tape exceeds MAX(NP(J) for even J) by NP(J - 1) + NP(J + 1). A slight exception, however, must be made for the first map zone since the left-reaching effects of the particles in its left buffer zone have already been taken into account (in the in-core map array) and, therefore, the particles falling into its left buffer zone need not be duplicated.

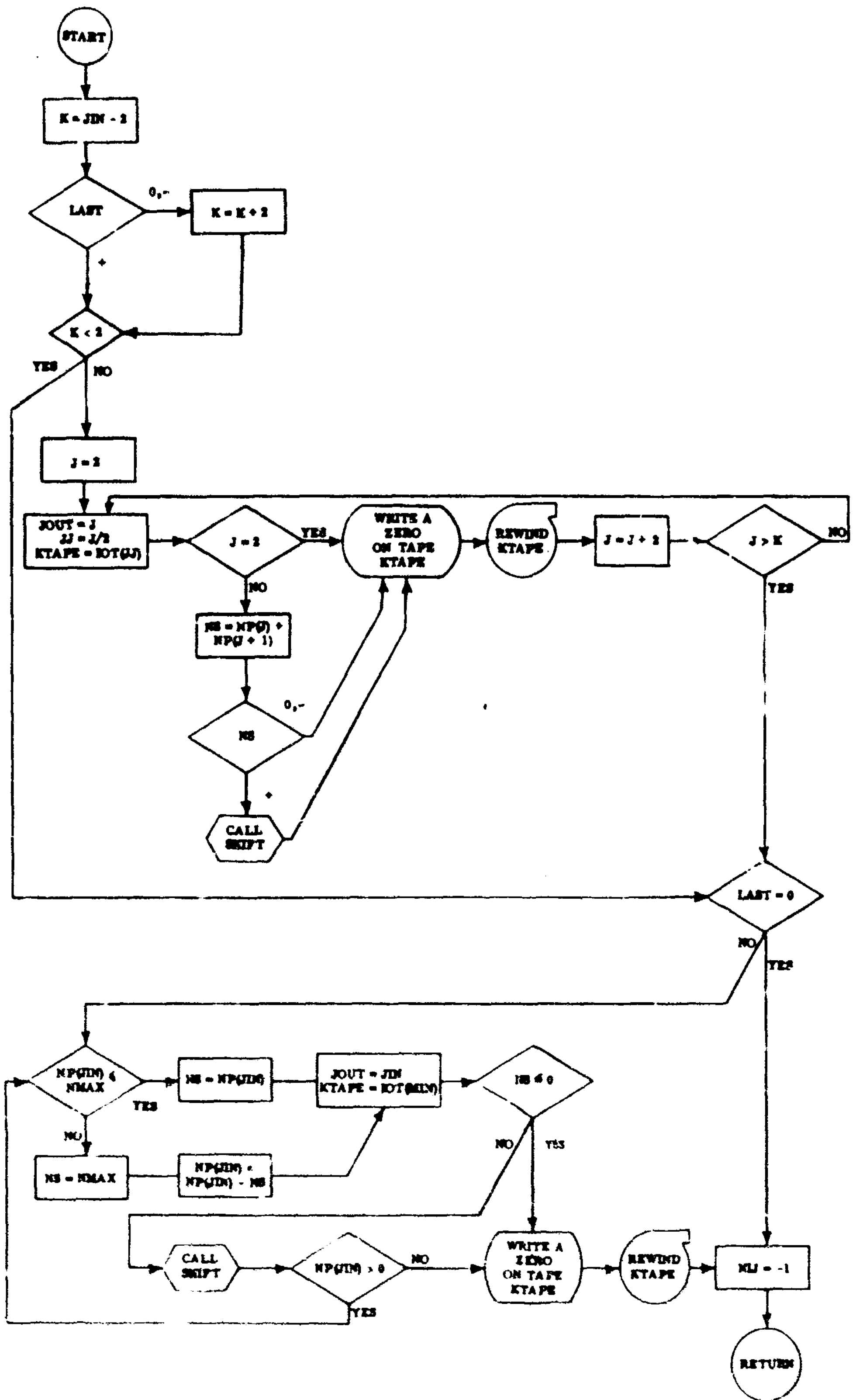
After selecting MAX [NP(J) for even J, NP(1) + NP(2)], subroutine COUNT adds the appropriate buffer zone counters to compute the number of particle descriptions to be dumped and puts the result in parameter NS. Next it sets the parameter KTAPE equal to the identification number of the tape on which the forthcoming dump operation (subroutine SHIFT) should write and then returns.

Subroutine CRDP (FC-6)

The purpose of subroutine CRDP (core dump) is to empty the particle arrays of all particle descriptions except those that can be processed into the next load of the map array, OMAP( ). CRDP is actually a control program, since it uses subroutine SHIFT to do the writing of sets of particle descriptions onto appropriate map zone memory tapes. (SHIFT does not actually clear (store zeros in) all words of each affected particle description in the particle arrays, but merely sets the appropriate KTR(J) entries to zero to indicate that the Jth lines in the particle arrays are available for reuse.) CRDP also makes the adjustments required to keep the particle counter array NP( ) current. It should be noted that CRDP does not dump the descriptions of particles falling into the first sort zone (J = 2) onto tape. These particles are left in the memory array for immediate processing into the next printed map zone. Note also that CRDP writes a final zero on each sort tape as an indication of the end of the data on the tape.



FC-5. Subroutine COUNT



FC-6. Subroutine CRDP

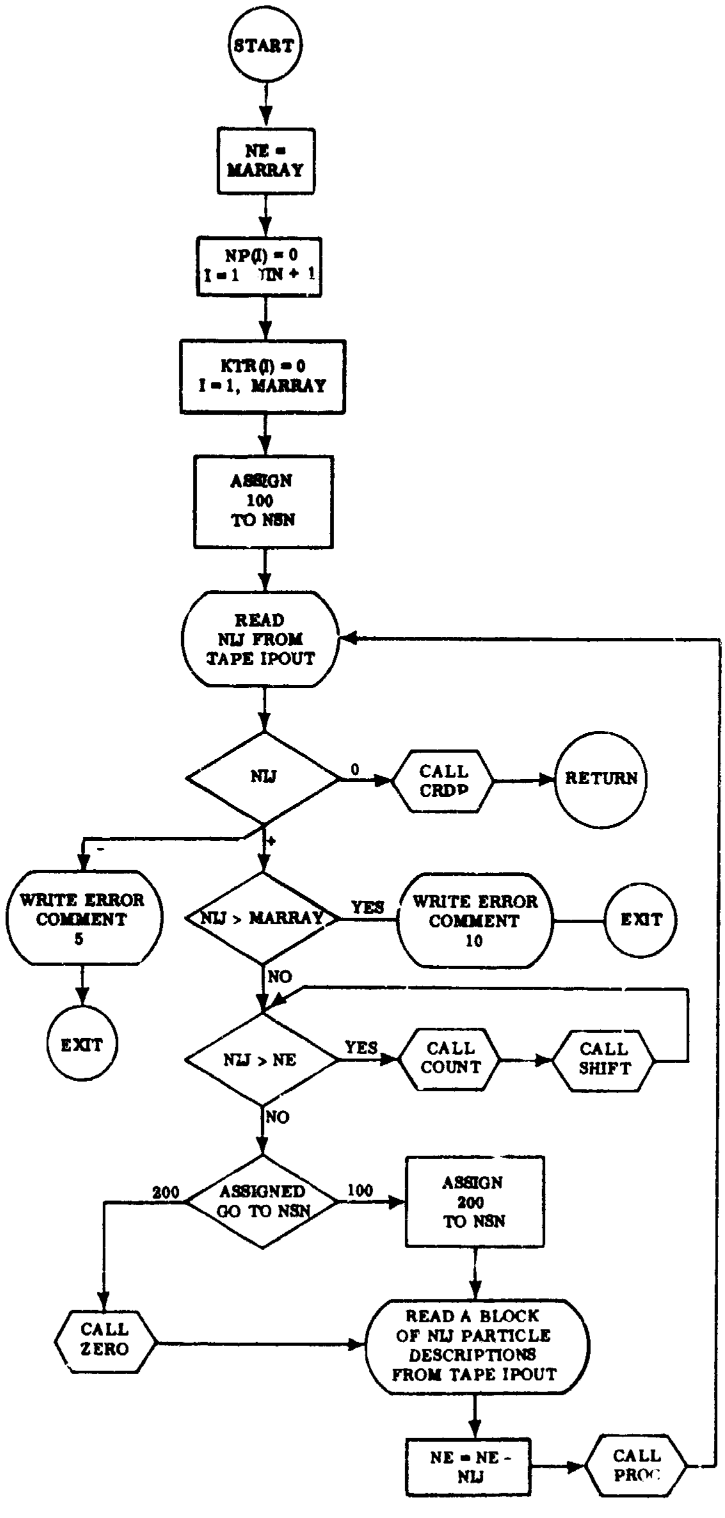
Subroutine LETSGO (FC-7)

This subroutine, like RUN1, is a specialized executive program, but it may call subroutines COUNT, PROC, SHIFT, and ZERO. It is used onlv when the data on the current input tape must be sorted because the required output map is too large to fit completely into high speed memory at one time. LETSGO first sets NE, the counter of empty lines in the particle arrays, at the full size of the arrays, and then clears the zone counters NP(I) and the particle zone indicators KTR(I). Next, it reads a particle block count NIJ and tests NIJ for the termination condition (NIJ = 0). In the event of termination CRDP is called to see that the content of the particle array is written out onto the appropriate tape (if required). If NIJ is positive, other tests are performed and, if necessary, COUNT and SHIFT are called to make room for the incoming data block. Thereafter, except for the first pass, ZERO is called to group the number of empty particle array lines required for the incoming particle block.

The particle block is then read into the computer and subroutine PROC is called to process the particle (or cloud subdivision) data. This processing consists of determining which numbered map zone or buffer zone the central particle falls into and recording that zone's identification number in the central particle's zone indicator parameter KTR( ). At this time PROC also uses CALC to process into the map array OMAP( ) all those central particles that affect the map area currently being evaluated.

Subroutine MAP (FC-8)

This subroutine writes complete fallout maps on the system output tape ISOUT for batch-printing. It writes a map title, a description of what quantity the map portrays, and an indication of the map's style of presentation (format). It divides the output map into printer strips on the basis of the printer width parameter INC. It prints a strip count (MAPRUN) at the top of each strip for identification purposes. Since an individual map may consist of more than one map array full of data, it is necessary that MAP operate correctly, even if an individual map must be produced by a sequence of calls to MAP. This feature is facilitated by the parameter MAPRUN, which is zero at the time of the initial call of subroutine MAP and is positive thereafter.



FC-7. Subroutine LETSGO

Following the detailed flow chart of subroutine MAP, we see at the beginning a transfer on the basis of MAPRUN to a first-pass code if MAPRUN equals zero. In this first-pass code parameter initializations are performed, a map title is written, the display option control parameter, JC(1), is checked for an acceptable value, and then a branch transfer is made to a code that writes the presentation style title and makes control transfer assignments within the map writing loops.

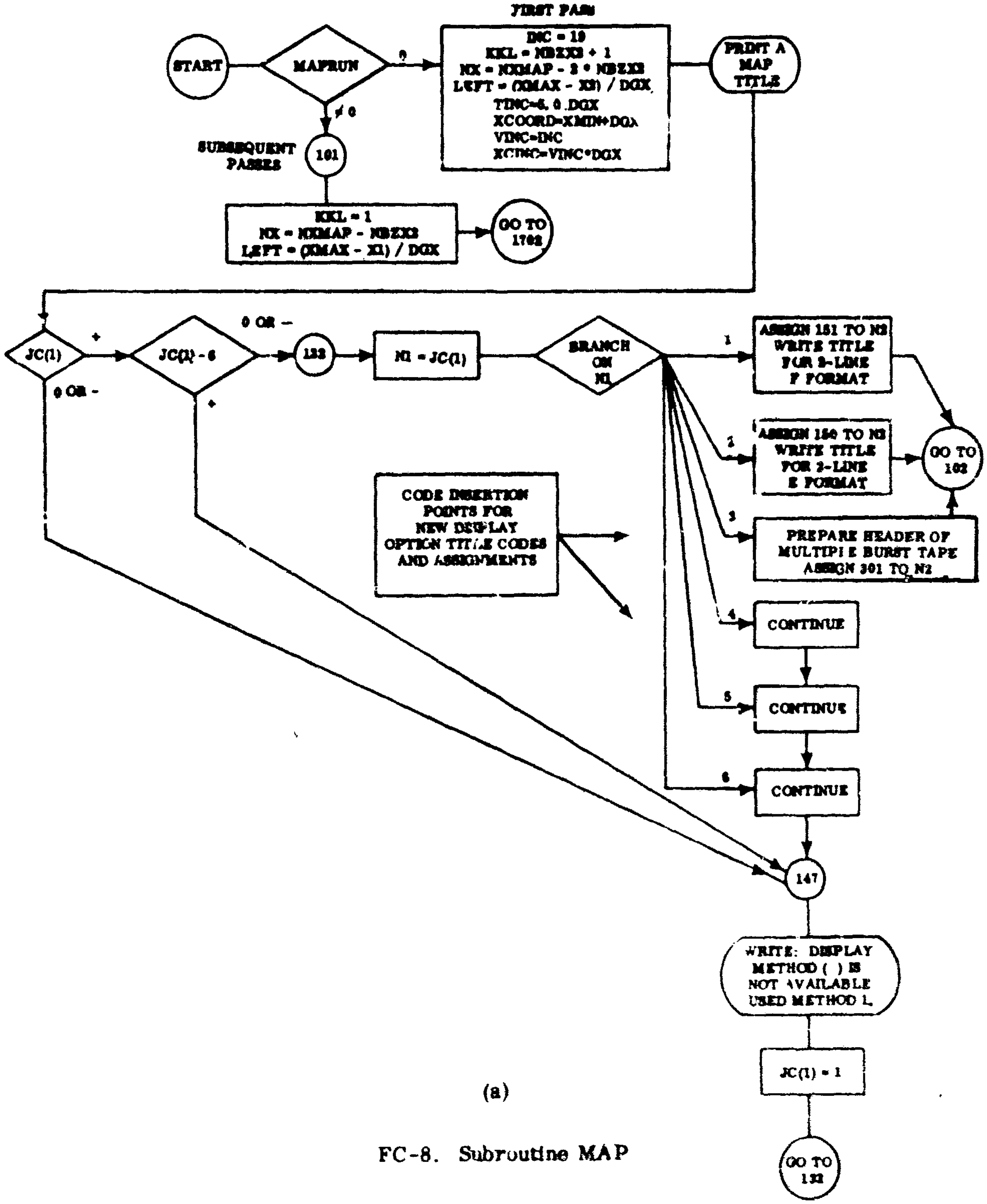
Between the statement numbers 102 and 170 a two-part title describing the quantity presented in the map is written. Between statement numbers 170 and P_1 initializations are made for the three nested map writing loops. At the time when P_1 is first reached M contains the number of printer strips that are to be produced, and LEFT has the number of columns that should appear on the last printer strip.

At P_1, which is the return point for the outer map writing loop (printer strip loop), MAPRUN, the counter of printer strips, is incremented and strip title is written. Also, KL, the lower index for retrieval from the one-dimensional map array OMAP, is set at its initial value. Note that in the iteration KL progresses from its largest value to its smallest value to invert the map which is stored numerically inverted in the map array.

At P_2, the return point for the middle map writing loop (printer line loop), KH, the upper index for retrieval from the map array, is set and KDC, an index for the printer line integer array JMAP, is initialized.

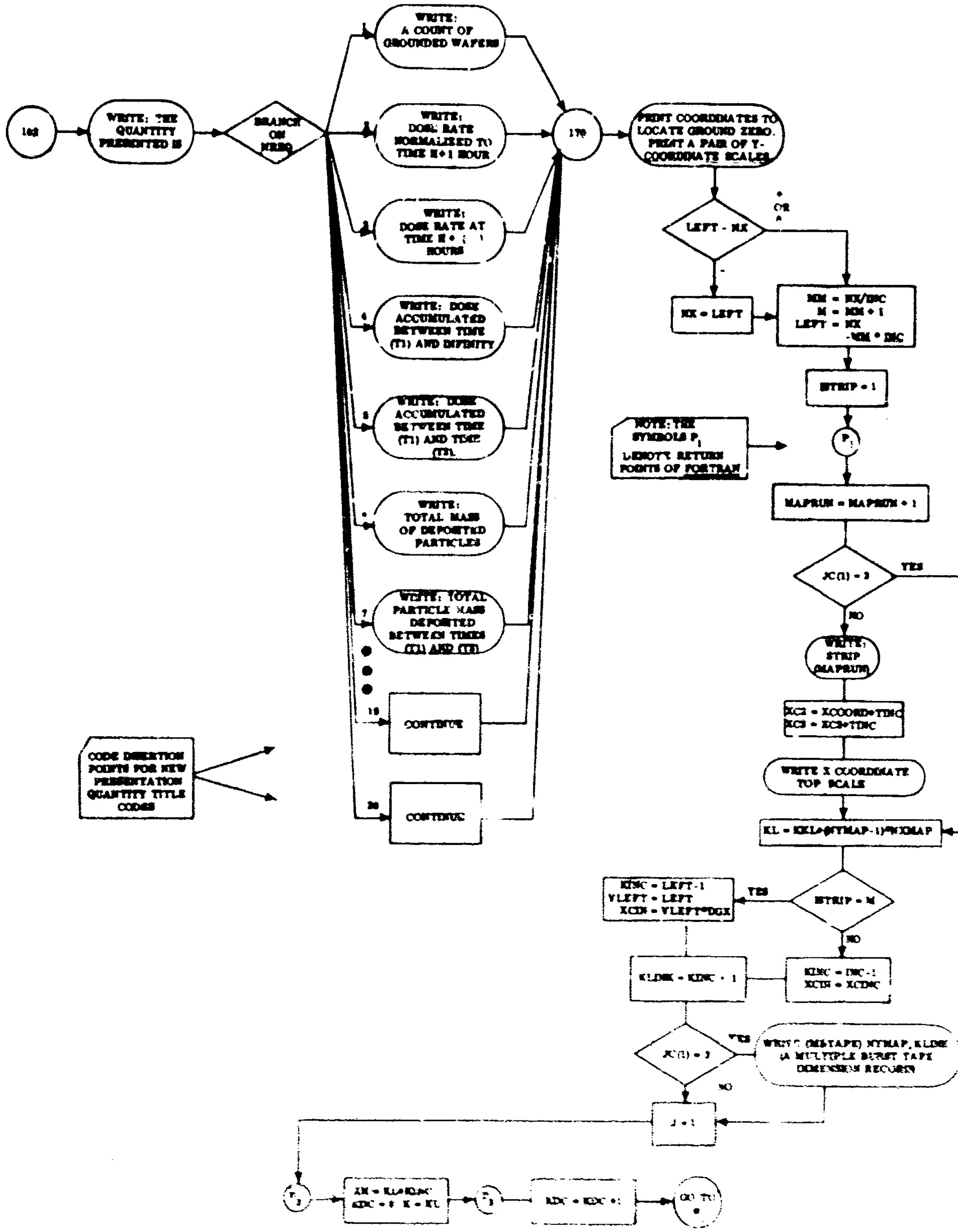
At P_3, the return point for the last map writing loop (data point loop), KDC is incremented and a transfer is made to the desired presentation code on the basis of previous assignment. The two furnished printer display codes take their inputs from the map array and place their results back into the map array and into the integer printer line array JMAP. All map producing codes return to statement number 300.

Below 300 the printer lines are written onto the output tape, suitable indexing operations are performed, and return is made to deal with either the next line in the current strip or the first line (and title) on the next strip, or a final return is made to the calling program. Note that if entrance is made to MAP with MAPRUN set positive as a consequence of a previous entrance, the overall titles will not be printed again and strip counting will be resumed where it had been left off.



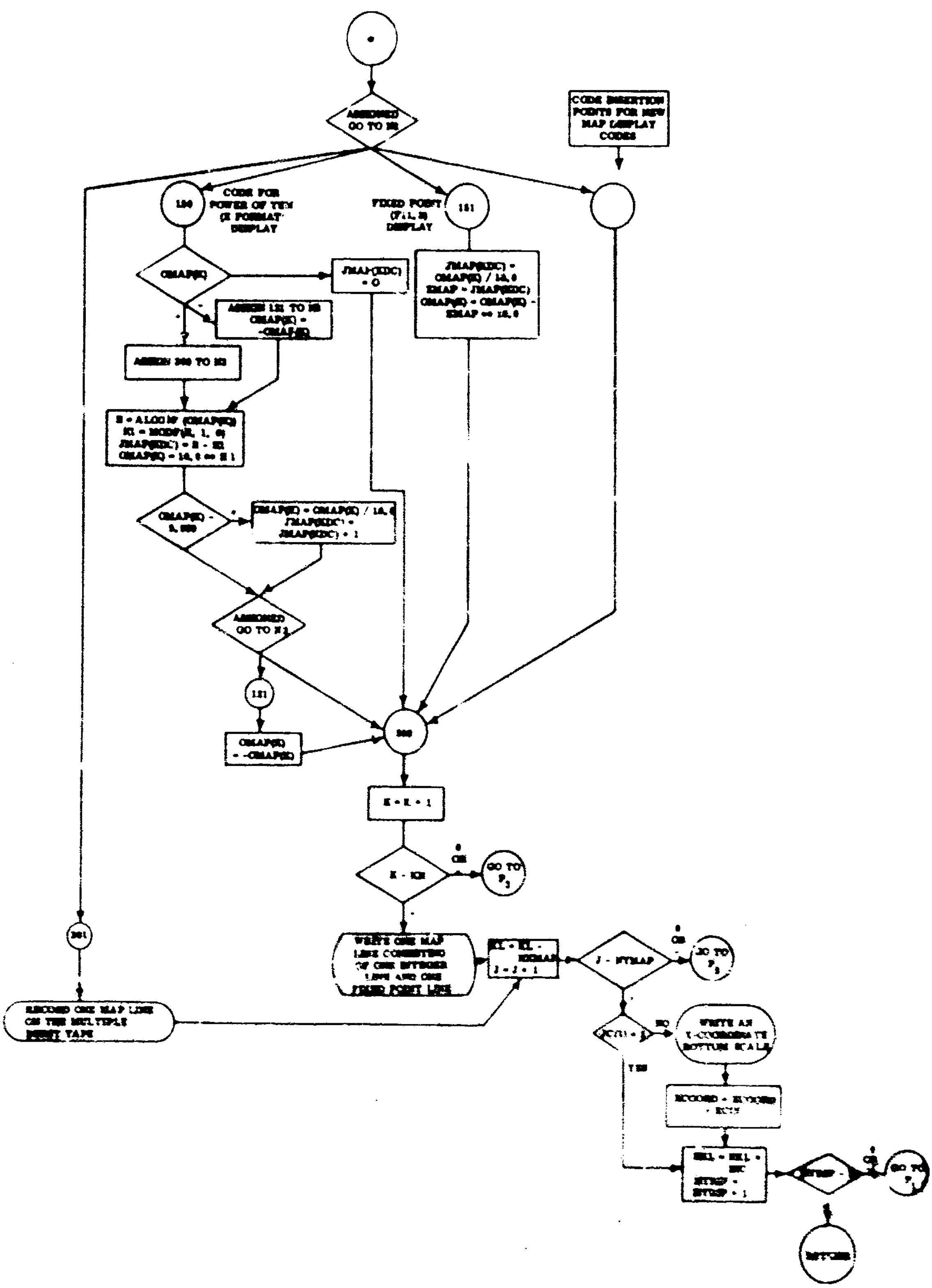
(a)

FC-8. Subroutine MAP



(b)

FC-8 (Cont'd.) Subroutine MAP



(c)

FC-8 (Cont'd.) Subroutine MAP

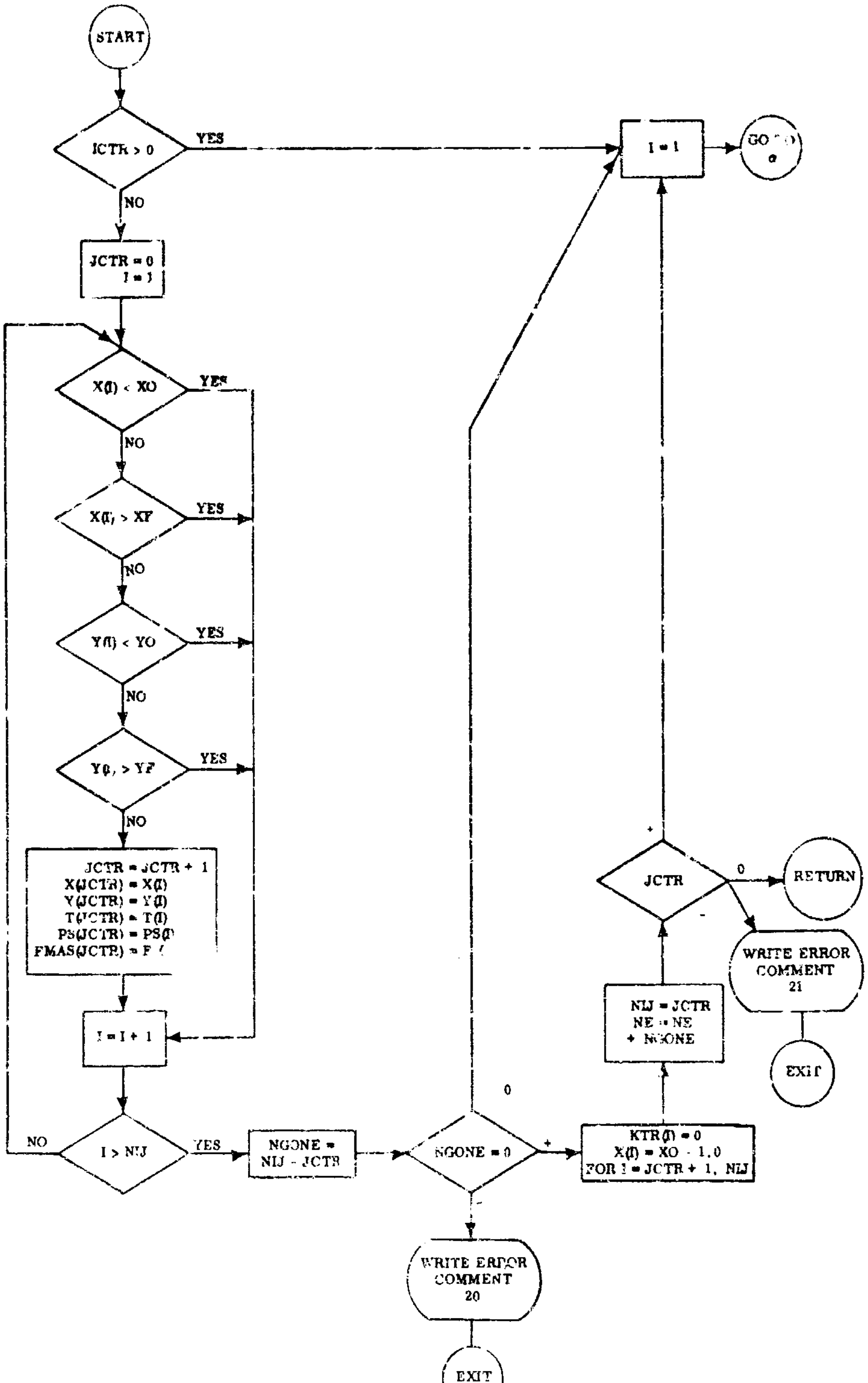
Subroutine PROC (FC-9)

This subroutine is called by LETSGO to sort (classify) particle descriptions, and it calls CALC to actually interpret into the map array those particles which affect the current map image. If the value of ICTR is zero upon entrance, a transfer is made to a code which discards particle descriptions that fall outside the user's area of interest and consolidates those remaining at the top of the particle array. If ICTR is not zero, this code is bypassed and a transfer is made immediately to a code which assigns values to the KTR array for those particle descriptions which cannot be immediately interpreted into the map array, and CALC is called to interpret those remaining.

The value assigned to the KTR for each particle description indicates into which map zone or buffer zone the particle has fallen. This value is computed by the loop beginning at the point labeled α where the east-west distance between the particle position and XO, the eastern boundary of the extended area of interest (see Figure 2) is computed and stored in R. Thereafter, the program determines the classification parameter KTR for each particle by alternately subtracting the width of a buffer zone (BZ2), and the width of a map zone exclusive of buffer zones (DELTAX), from R, and performing a test against zero after each subtraction. While this loop of subtractions is being carried out, the parameter J is used to record the number of the map zone counter array element pertinent to the particle. Note, however, that central particles falling into the area of the in-core map array can be processed immediately into the map array by a call to CALC and, therefore, need not be stored permanently in the particle arrays. Thus, their classifications need not be stored in their KTR(J) which remain zero. It should also be noted that the indexing of the counter array NP( ) is offset by two from the classification index J. This leads to a usage of NP(J) as the counter for the number of central particles falling into the first buffer zone to the right of the first printed map area, and NP(2) as the counter for the first map zone to the right of the first printed map, and so forth.

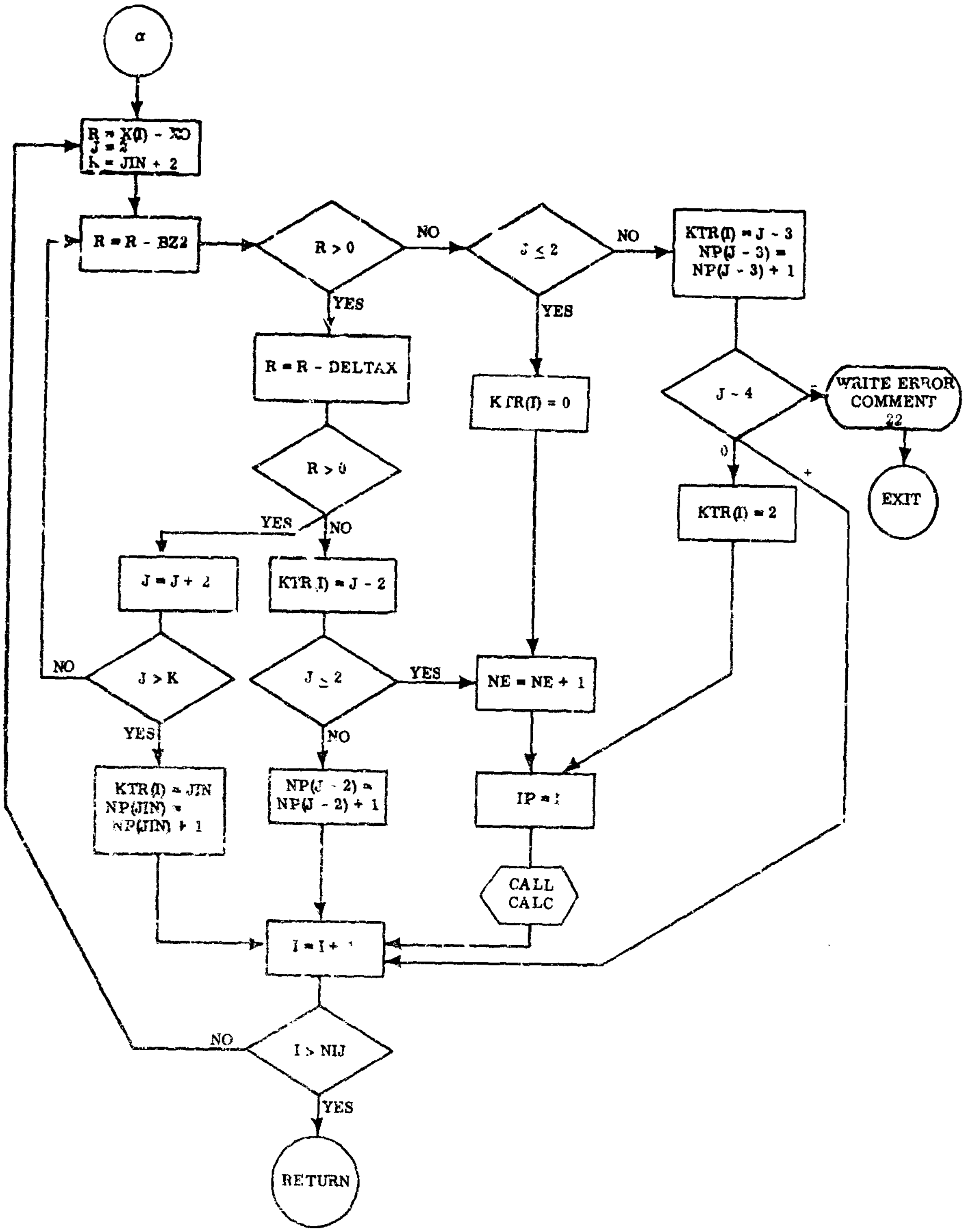
Subroutine RUN1 (FC-10)

This subroutine is a specialized executive program which calls only subroutine CALC. It is used in the situation where only one pass of the input data tape is required in order to fully account for the data on the tape. This situation arises either



(a)

FC-9. Subroutine PROC



(b)

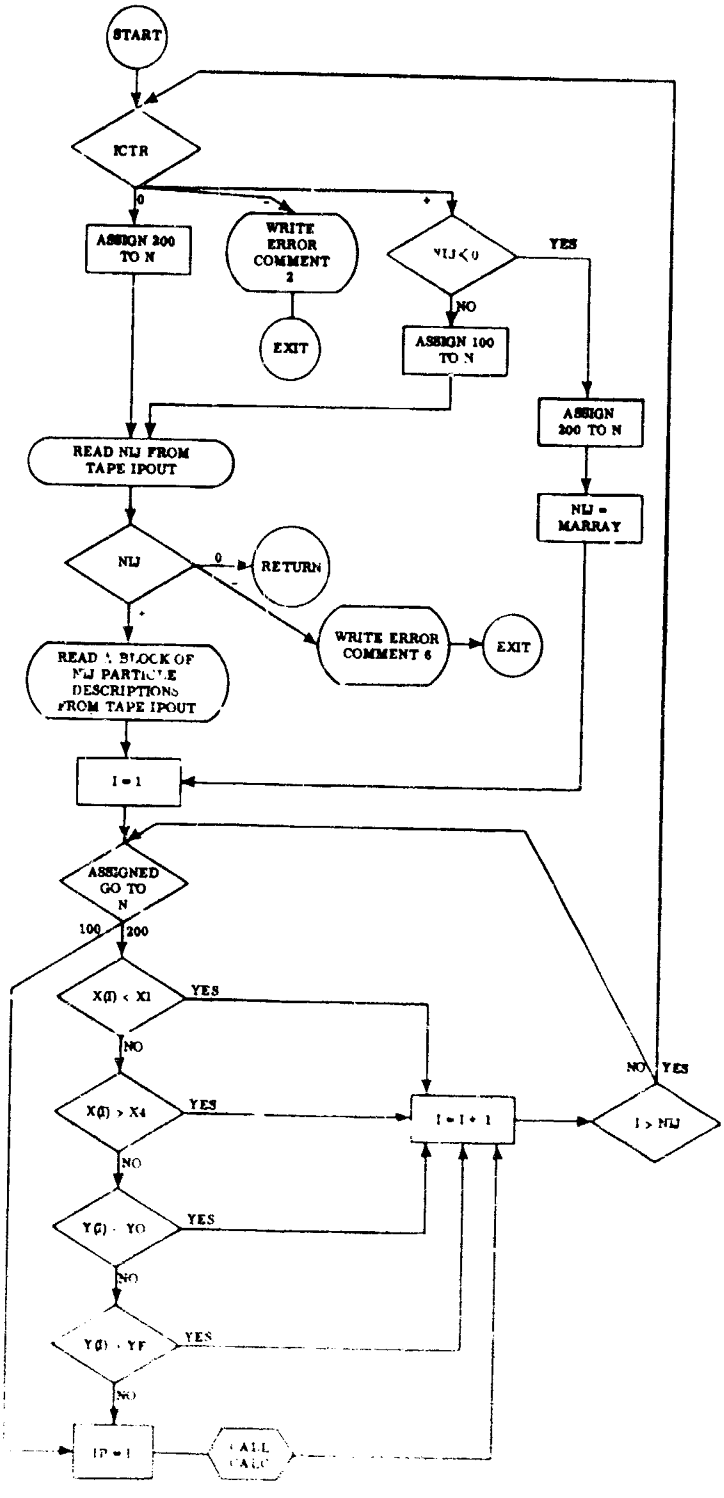
FC-9 (Cont'd.) Subroutine PROC

when all of the required map will fit within the map array at one time or when a previously sorted input data tape is being processed. In the first case each input coordinate point must be checked to see if its associated cloud subdivision affects the map. If not, the impact point is not interpreted into the map. In the second case, when a prior sorting operation guarantees that only necessary particle descriptions are on the input tape, this detailed checking procedure is bypassed.

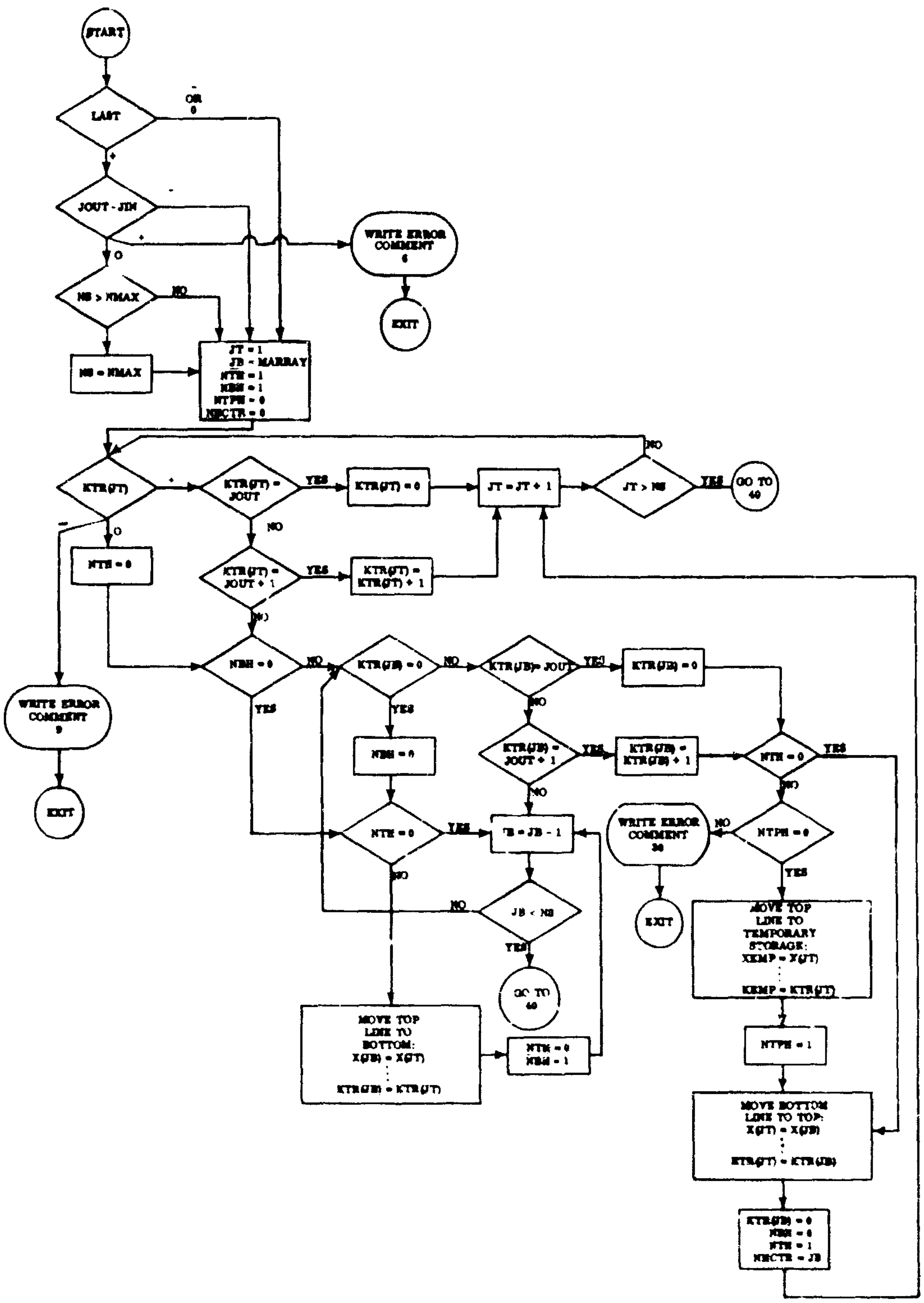
Subroutine SHIFT (FC-11)

The basic function of this subroutine is to collect into the top of the particle arrays NS, particle descriptions of the selected class (those having their KTR variable equal to JOUT) and then write them onto the appropriate tape (KTAPE). Adjustments are made to the count of the number of members in the selected class, to NE, to the count of available lines in the particle arrays, and to the KTR variables of those particle descriptions which are read out onto tape either for the first or second time, in accordance with the need to duplicate descriptions of particles that fall into buffer zones.

The actual sort procedure is one which usually moves only the minimum amount of information and, at worst, a temporary description storage may be used once (for one description) during each execution of SHIFT. In this procedure JT is an index that proceeds from the top of the arrays (JT = 1) toward the bottom, and JB proceeds from the bottom toward the top. The program first examines the top line to determine if it is a member of the class to be dumped (KTR(JT) = JOUT). If it is, it is left in place with its KTR set to zero, and then the top index JT is incremented so that the next line can be considered. If the top line is empty (KTR(JT) = 0), the program goes to the bottom of the array, using index JB to try to find a particle which is to be dumped and thus can be moved into the empty line, JT. If, on the other hand, the top line contains a particle description that is not to be dumped, the program goes to the bottom of the array to seek an available line to which the top particle can be moved. In this general way the program proceeds by skipping particles to be dumped when they are found in the top, moving particles to be dumped to the top when they are found in the bottom, and moving particles that are not to be dumped from the top to the bottom. The sorting stops when NS particles of the class to be dumped have been collected into contiguous cells in the top of the particle arrays.

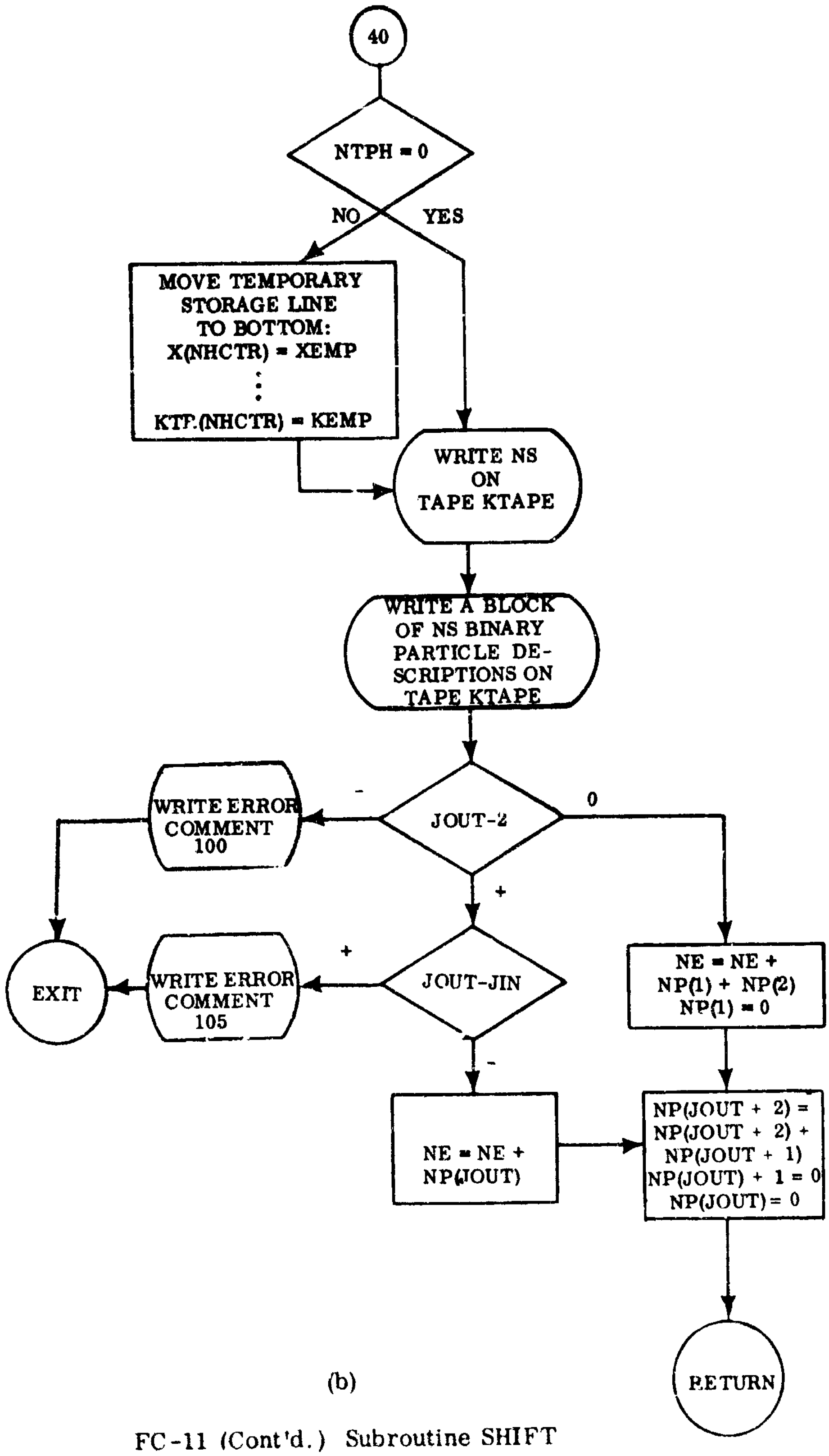


FC-10. Subroutine RUN1



(a)

FC-11. Subroutine SHIFT



(b)

FC-11 (Cont'd.) Subroutine SHIFT

Next, the counter NS followed by NS particle descriptions are written onto the memory tape identified by KTAPE. NE, the counter of empty (available) lines in the particle arrays, is increased by the number of lines that have just been made available and appropriate adjustments are made to the affected members of the NP( ) class counter array . Then the program returns.

Subroutine SLIDE (FC-12)

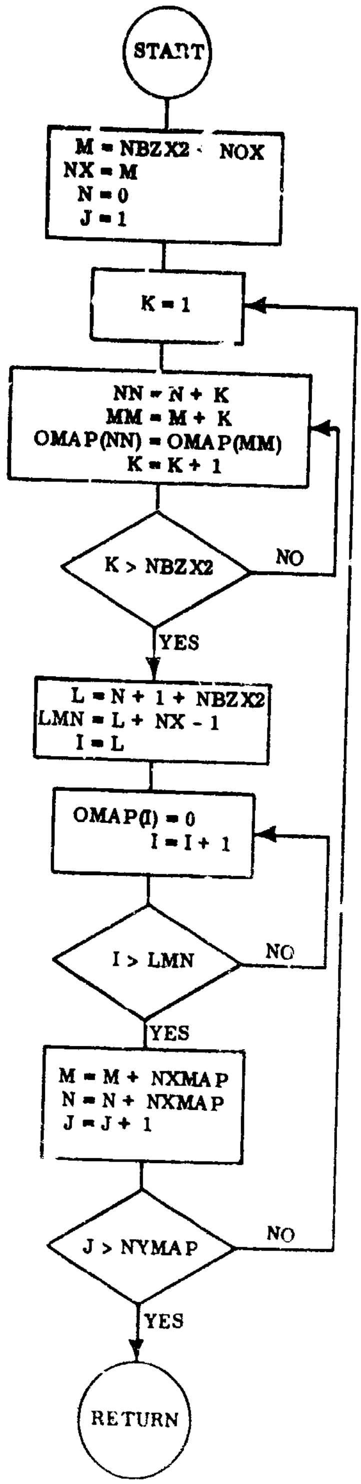
It is the purpose of subroutine SLIDE to move the (incomplete) map ordinates which exist in the right (eastern) buffer zone to the left buffer zone and then to blank out the midsection and right buffer zone parts of the map array. The common argument variables NBZX2, NOX, NXMAP, and NYMAP are used to communicate the layout of the map array's buffer zones and midsection to subroutine SLIDE.

Subroutine ZERO (FC-13)

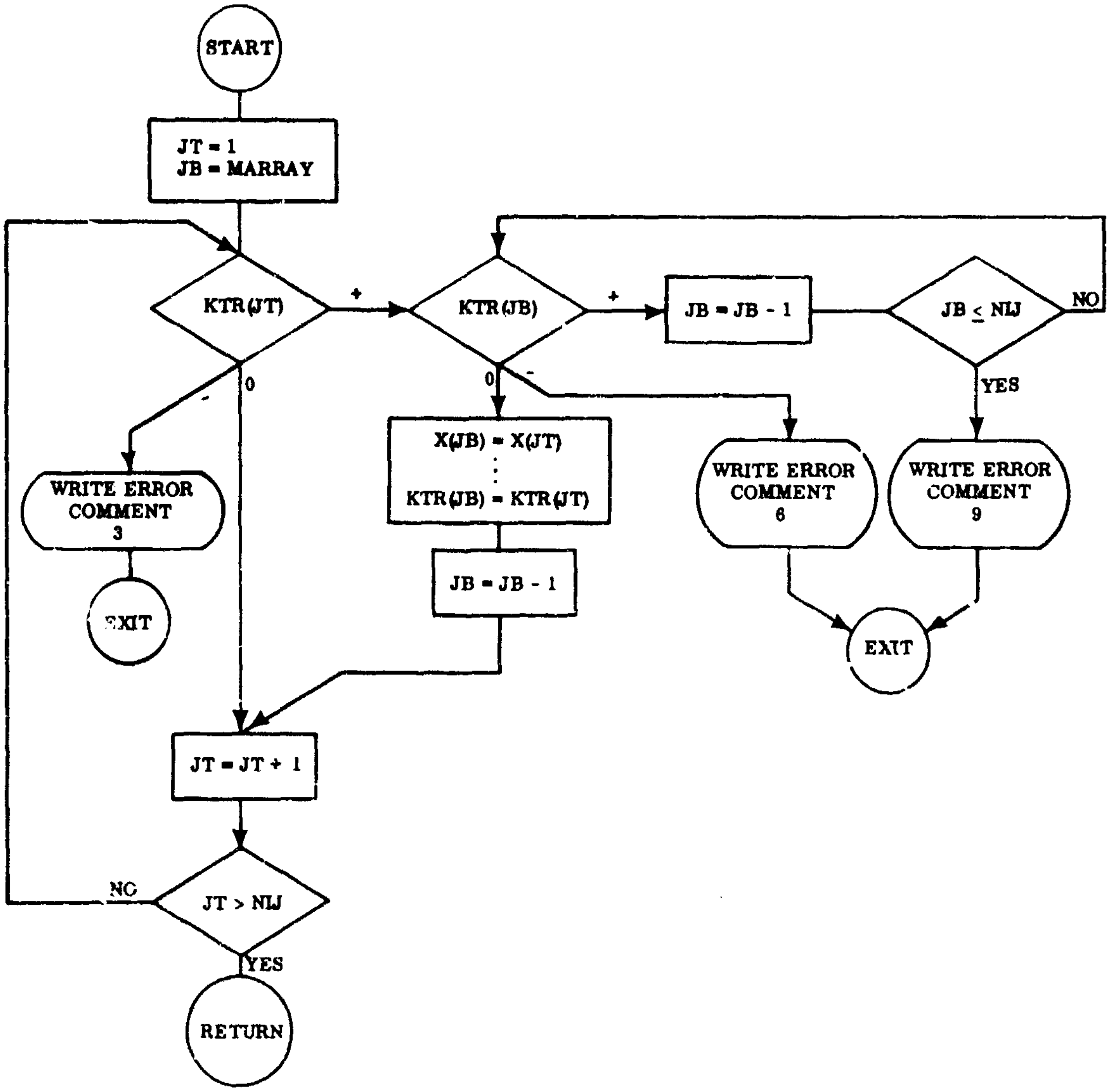
This subroutine merely scans down from the top of the particles array and collects NIJ empty particle descriptions in the top NIJ array positions. Empty particle descriptions are denoted by a zero in the associated position (same index) of the KTR array.

Subroutine DIFUZ1 (no flow chart)

This subroutine accounts for the effects of atmospheric diffusion through the use of an elementary model that adjusts the sizes of cloud subdivisions on the basis of only the amount of time that the subdivision spends in flight. See Volume IV for a discussion of the basis of this program.



FC-12. Subroutine SLIDE



FC-13. Subroutine ZERO

USER INFORMATION

Card Inputs

Like each of the major subdivisions of DELFIC, the Output Processor requires a deck of input cards to identify and control its operation. In brief, these inputs consist of, first, a single set of identification and overall control data which will be referred to as "initialization data" and, second, a series of "local" data sets which indicate the geographic limits of the map to be produced by the program. Within each "local" data set there may be any number of individual map requests of the form:

NREQ T1 T2 MASCHN ,

where NREQ is a code integer denoting the kind of computation to be performed, T1 and T2 are time arguments to be used in deposited mass, exposure rate, and accumulated exposure computations, and MASCHN is a mass chain number that is specified only when the output is to be in terms of that single mass chain. Each map request results in the preparation and printing of a separate map showing the output indicated by the request code NREQ. The end of a "local" data set is indicated to the Output Processor by a map request card having a zero in the NREQ code field (a blank card will suffice).

Table 2 gives details of the card formats, program variable names, and the meanings and uses of variables for initialization data and local data sets. Note that a final blank card is required to indicate the end of the data deck and cause the program to terminate correctly, also, that certain card inputs to the particle activity module (subroutine PAM1) may be called for following the fourth input card for the Output Processor.

Card 1. Output Processor Run Identification. This card can be used to uniquely identify the current run of the Output Processor. The content of this card is made part of the hard copy output produced by the run.

Card 2. Available Tape Identifications. When required, extensive use is made of secondary tape memory so that the Output Processor can be reasonably efficient in producing large output maps or tabulations. This card should contain the "logical"

TABLE 2

DETAILS OF THE OUTPUT PROCESSOR DATA DECK

Data Set	Card No.	Content	Name of Program Variable	Format
Initialization Data	1	72 character identifier for the Output Processor run.	OPID(J)	(12A6)
	2	List of logical tape numbers of those tape units available for use in sorting	IOT(J)	(18I4)
	3	Overall control variables	IC(J)	(18I4)
	4	Printer description	IH, IV	(2I4)
Particle Activity Data Set (see Vol. V)				
First "Local" Data Set	5	Map parameters limiting co-ordinates and grid intervals	XMAX, XMIN, YMAX, YMIN, DGX, DGY, GRUFF	(7F10.3)
	6	Local control variables	JC(J)	(18I4)
	7	First processing request on current map	NREQ, T1, T2, MASCHN	(I4, 2F10.3, I4)
	8	Second request		
	.	.		
	.	.		
	.	.		
		Request termination card (blank)		blank
Next "Local" Data Set		Next map specification See Card No. 5		
		Next local control variables See Card No. 6		
		Next deck if processing requests See Card No. 7		
		Request termination card (blank)		
Final Data Card		Data deck termination card (blank)		blank

identification numbers of all tapes which are available for use by the Output Processor. The program checks the input values to exclude FORTRAN system tapes and the grounded particles tape, and use of the remaining available tapes is made only when required for sorting particle data. As many as 18 tape numbers may be listed but at least one is required by the program.

Card 3. Overall Control Variables. Provision has been made for the specification of 18 unique overall control variables whose values are stored in the program in the array [IC(J), J=1, 18]. At present only two of these variables have been given functions within the program, and the others remain for use in control and interprogram communication. The functioning variables are as follows:

IC(17) Controls the entrance to the Output Processor. IC(17) > 0 causes the program to stop without entering the Output Processor proper. This setting is used if only a printing of the grounded particles tape is desired.

IC(17) = 0 causes a normal entrance to the main body of the Output Processor regardless of whether the grounded particles tape has been printed.

IC(18) Controls the option to print the content of the grounded particles tape. IC(18) > 0 causes the grounded particles tape to be printed. IC(18) = 0 bypasses the printing of the grounded particle tape.

Card 4. Printer Description. To simplify the production of spatially undistorted maps, the Output Processor needs constants which describe the character spacing of the off-line printer to be used. These constants IH and IV give respectively the horizontal and vertical character spacings of the printer in characters per inch. For the usual IBM printer, 10 and 6 are appropriate values for IH and IV.

Card 5. Map Parameters. The desired output map must be characterized by the user who must specify its limiting coordinates and its grid intervals (grid point spacing). All maps are rectangular in shape and north-south, east-west in orientation, with north always at the top. The variables XMAX and XMIN indicate respectively the maximum and minimum values of the east-west coordinates of the map. YMAX and YMIN similarly indicate maximum and minimum values of the north-south map

coordinates. To allow flexibility, the scaled spacing between grid points on the output map has been arranged to be set by the user. The variables DGX and DGY indicate the intergrid-point distances in the east-west and north-south directions respectively. It should be noted that on the printed map the actual physical spacing of the data points is fixed by the printer's character and line spacing. Map printing formats have been arranged to achieve the greatest reasonable data point density on the printed page, and on IBM printers this amounts to three lines per grid interval in the vertical direction, and six characters per grid interval in the horizontal direction. If the user wishes to have a map of some particular scale produced by the Output Processor, he must set the parameters DGX and DGY to account for both the character spacing of the printer as well as the interdata-point character counts used by the program (3 lines per interval in the vertical direction and six characters per interval in the horizontal direction). Obviously, zero values should never be assigned to DGX or DGY.

An option exists within the Output Processor to cause it to adjust the grid intervals put in by the user so as to yield an undistorted map—a map on which the same scale factor applies in all directions. If the user has specified, via parameter JC(16), the automatic undistorted map option, the program makes use of either DGX or DGY as the scale factor basis, depending upon which of these two parameters will yield the largest undistorted map (smallest scale factor). The last item on this card is a ground roughness factor (GRUFF) by which the program multiplies all computed exposures and exposure rates before display.

Card 6. Local Control Variables. Provision has been made for the specification of 18 unique local control variables whose values are stored in the program in the array [JC(J), J=1, 18]. At present, only four of these variables have been given functions within the program, and the others remain for use in control and interprogram communication at the local level. The functioning variables are as follows:

JC(1) Output format control variable JC(1) = 1 results in the printing of the output map in a two-line E format which has the power of ten printed on one line and the associated multiplier printed immediately below it (see p. 7).

JC(1) = 2 results in the printing of a two-line F11.3 format which has the six highest order characters printed on the first line and the five lowest order characters on the second line (see p. 7).

JC(1) = 3 causes the Output Processor to write a map image onto the multiple burst tape (the unit identified in parameter MBTAPE as logical 11). This tape is written in a format acceptable to the separate multiple burst tape processing program MULTIB (see Volume VII of this documentation). When using the multiple burst option, care should be taken to see that the tape unit identified by parameter MBTAPE is not also specified as being available for use during the sorting operations of the Output Processor (Card 2).

JC(15) Diffusion control parameter JC(15) > 0 brings about the use of the diffusion subroutine DIFUZ1. JC(15) = 0 bypasses the diffusion model.

JC(16) Automatic undistorted map parameter JC(16) = 0 results in the automatic adjustment of the grid interval DGX or DGY to yield an undistorted output map.

JC(16) ≠ 0 results in no adjustment to the grid intervals.

JC(18) Grid interval adjustment control parameter

JC(18) = 0 indicates the user's permission for the program to make a small adjustment to the grid intervals to achieve greater program efficiency. This adjustment may result in increased map resolution but cannot result in decreased resolution.

JC(18) > 0 indicates the user's wish to have no adjustment made to the grid intervals. JC(18) > 0 overrides JC(16) = 0, i.e., for an automatic undistorted map, JC(18) and JC(16) must both equal zero.

Cards 7, 8 . . . Processing Requests. Table 3 presents the meanings of the computation codes NREQ and arguments T1 and T2 for currently available computation options. MASCHN is the mass chain number if the output is to be for a single mass chain. Otherwise, its field may be left blank.

TABLE 3

AVAILABLE COMPUTATION CODES

Computation Code NREQ	Computation Type Description
0	Termination of the set of requests
1	Count of wafers covering each output point
2	Exposure rate normalized to time H + 1 hour
3	Exposure rate at time H + T1 hours
4	Integrated exposure, H + T1 to ∞ accounting for time of arrival
5	Integrated exposure, H + T1 to H + T2 accounting for time of arrival
6	Total mass deposited
7	Total mass deposited from time H + T1 to H + T2
8	Integrated exposure, H + T1 to H + T2 assuming all particles have arrived by H + T1 hours
9	Same as 8 integrated to infinity
10	Concentration of an individual mass chain (curies/m^2)
11	Time of arrival of first fallout particle
12	Time of deposit of last fallout particle
13	Smallest particle size deposited
14	Largest particle size deposited
15	Mass from particles in size range T1 to T2
16	H + 1 hour "normalized" exposure rate resulting from particles in size range T1 to T2 microns

Binary Input

The Output Processor Module takes binary input from the grounded particles tape (IPOUT) that is produced by the Transport Module. The structure and contents of this tape are described in detail in Table 4.

TABLE 4

THE GROUNDED PARTICLES TAPE, IPOUT
(Binary input to the Output Processor Module)

Logical Record No.	Record Content	Variable Names
1	Identification word (IPOUT)	IPOUT
2	Fission yield, mass of soil lifted, solidification temperature, time of solidification, spare, time at which transport was terminated, width of cloud subdivisions at time of definition, density of fallout particles, X, Y, and time coordinates of ground zero.	FW, SSAM, SLDTMP, TMSD, SIGMA, TW, HOB, NCL, TLIMIT, BZ, ROPART, XGZ, YGZ, TGZ
3	Run identifiers for Initial Conditions, Cloud Rise, Cloud Rise-Transport Interface, Transport, and Wind Field	(DETID(J), J=1, 12), (CRID(J), J=1, 12), (PSEID(J), J=1, 12), (TID(J), J=1, 12), (WID(J), J=1, 12)
4	Number of particle size ranges	NPS
5	Central particle size, associated mass, maximum particle size, and surface-to-volume ratio for each size range	PS(J), FMASS(J), PACT(J), SV(J), J=1, NPS
6	Topography identifier	TOPID(J), J=1, 12
7	Number of particle descriptions in the following data block	N
8	X coordinate, Y coordinate, time, particle size, and mass associated with each of N particles	NP(J), YP(J), TP(J), PS(J), FMAS(J), J=1, N
9	Same as record 7	
10	Same as record 8	
. . .	Pairs of records like 7 and 8 are repeated until all grounded particles are recorded	
Last record	The end of the grounded particles data set is indicated by a particle count of zero	N=0

FORTRAN LISTINGS

```
$IBFTC CALCA    LIST,DECK,M94/2                                          CALC
      SUBROUTINE CALC                                                    CALC
C     P. FLUSSER  TECHNICAL OPERATIONS RESEARCH  OR  CALC                CALC
C     26  FEB  67                                                        CALC
C*** THIS SUBROUTINE DETERMINES WHAT OUTPUT IS REQUESTED AND              CALC
C*** COMPUTES THE FINAL RESULTS.  THESE IT STORES IN AN ARRAY CALLED     CALC
C****      ØMAP.                                                         CALC
C                                                                        CALC
C ***********************************************************************CALC
C                                                                        CALC
      CØMMØN /SET1/                                                      CALC
     1         DIAM    ,DETID(12),IRISE   , IEXEC   , ISIN    , ISØUT   , CALC
     2         SD      , SPAR    , SSAM    , TIME    , TMP1    , TMP2    , CALC
     3         T2M     , U       , VPR     , W       , HBURST  , SCLDHB  , CALC
     4         TID(40) , RMIN    , IDISTR  , SPAR1   , MBTAPE  , FSUM    , CALC
     5         RUFSAM  , SPAR5   , SPAR6   , XØZ     , YØZ     , TØZ       CALC
      CØMMØN  /SET3/                                                     CALC
     1     BZ             ,PZZ            ,BZZ            ,SZZZ          CALC
     2    ,DELTAX         ,DGX            ,DGY            ,DIFCØN        CALC
     3    ,DIFADJ         ,FMAS(500)      ,FMASS(200)     ,IC(18)        CALC
     4    ,ICØN           ,ICTR           ,IH             ,IØT(18)       CALC
     5    ,IP             ,IPØUT          ,ITT(18)        ,IV            CALC
     6    ,JC(18)         ,JIN            ,JØUT           ,JPØUT         CALC
     7    ,KTR(500)       ,KTAPE          ,LAST           ,MAPRUN        CALC
     8    ,MARRAY         ,MIN            ,MXREQ                         CALC
     9    ,N              ,NA             ,NBZX           ,NBZX2         CALC
     1    ,NBZY           ,NCL            ,NE             ,NF            CALC
     2    ,NIJ            ,NMAP           ,NMAX           ,NØX           CALC
     3    ,NP(21)         ,NREQ           ,NS             ,NTAPES        CALC
     4    ,NTAPET         ,NTASK          ,NXMAP          ,NYMAP         CALC
     5    ,YMIN           ,P3(500)        ,PSIZE(200)     ,PACT(200)     CALC
     6    ,RØPAPT         ,SV(200)        ,T(500)         ,T1            CALC
     7    ,T2             ,TLIMIT         ,X(500)         ,XF            CALC
     8    ,XØ             ,XMAX           ,XMIN           ,XNMAP         CALC
     9    ,X1             ,X2             ,X3             ,X4            CALC
     1    ,Y(500)         ,YF             ,YØ             ,YMAX          CALC
      CØMMØN/DECAY/                                                      CALC
     1     IGØ            ,JD          ,KDØS           ,TENTER           CALC
     2    ,TEXIT          ,TIME                                          CALC
C                                                                        CALC
      CØMMØN/ØUTPUT/                                                     CALC
     1     FISNUM         ,FP     (200) ,FW            ,ITAB       ,JGØ   CALC
     2    ,MASCHN         ,SIGMAS                                        CALC
      CØMMØN /SET4/   ØMAP(4000)                                         CALC
C                                                                        CALC
C ***********************************************************************CALC
C                                                                        CALC
 210  FØRMAT(8HOFØRMULAI6,67H IS UNAVAILABLE. CØMPUTATIØN WAS CØNTINUED  CALC
     1FØR A REQUEST ØF TYPE 1.)                                          CALC
C                                                                        CALC
C ***********************************************************************CALC
C ***********************************************************************CALC
C                                                                        CALC
C                                                                        CALC
      DATA PRØGRM/6H CALC /                                              CALC
C                                                                        CALC
      ASSIGN 213 TØ NØRD                                                 CALC
      GØ TØ(101,102,103,104,105,106,107,102,102,102,112,113,114,115,116  CALC
     1,117,109,110,111,120),NREQ                                         CALC
C                                                                        CALC
```

```
C 101  COUNT OF GROUNDED WAFERS
  101 F=1.0
      GO TO 100
C
C 103  DOSE RATE AT TIME H+T1 SECONDS
 103  IF(T(IP) -T1)102,102,777
C
C 104 DOSE ACCUMULATED FROM TIME H+T1 SECONDS TO INFINITY
 104  IF(T(IP)-T1)1041,1041,1042
 1041 TENTER=T1 -TGZ
      GO TO  130
 1042 TENTER=T(IP) -TGZ
      GO TO 130
C
C 105  DOSE ACCUMULATED FROM TIME H+T1 TO TIME H+T2 SECONDS
 105  IF(T(IP)-T2)1051,777,777
 1051 IF(T(IP)-T1)1052,1052,1053
 1052 TENTER=T(IP)-TGZ
      GO TO  130
 1053 TENTER=T1 -TGZ
      GO TO 130
C
C 106 TOTAL PARTICLE MASS DEPOSITED
 106  F=FMAS(IP)
      GO TO 100
C
C 107 TOTAL PARTICLE MASS DEPOSITED BETWEEN TIMES T1 AND T2 SECONDS
 107  IF(T(IP)-T2)1071,777,777
 1071 IF(T(IP)-T1)777,777,106
 130  CALL PAM2
C
C 102 FIND INDEX OF PARTICLE SIZE CLASS
 102  DO 131 J=1,ITAB
      IF(PACT(J).LE.PS(IP))GO TO 132
 131  CONTINUE
      CALL ERROR(PROGRM,131,ISOUT)
      GO TO 777
C
 132  IPS=J
      F=FP(IPS)*FMAS(IP)/(FMASS(IPS)*RUFSAM)
      GO TO 100
C
C 112 TIME OF ARRIVAL
 112  ASSIGN 211 TO NORD
 1121 F= T(IP)
      GO TO 100
C
C 113 TIME OF CESSATION
 113  ASSIGN 212 TO NORD
      GO TO 1121
C
C 114 SMALLEST PARTICLE SIZE
 114  ASSIGN 211 TO NORD
 1141 F= PS(IP)
      GO TO 100
C
C 115 LARGEST PARTICLE SIZE
 115  ASSIGN 212 TO NORD
      GO TO 1141
C
```

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```
C 116 RADS FRØM PARTICLES IN THE SIZE RANGE T1 TO T2 MICRØNS.
 116  IF(PS(IP).GE.T1.AND.PS(IP).LE.T2)  GØ TØ 106
      GØ TØ 777
C
C 117 HR-1 HR NØRMALIZED DØSE RATE RESULTING FRØM PARTICLES IN THE SIZE
C     RANGE T1 TØ T2 MICRØNS
 117  IF(PS(IP).GE.T1.AND.PS(IP).LE.T2)  GØ TØ 102
      GØ TØ 777
C
C
C************************ CØDE INSERTIØN PØINTS ************************
  109 CØNTINUE
 110  CØNTINUE
 111  CØNTINUE
C************************ CØDE INSERTIØN PØINTS ************************
C
 120  CØNTINUE
      WRITE (ISØUT,210)NREG
      NREG=1
      GØ TØ 101
  106 CØNTINUE
C
C     CALCULATE WAFER BØUNDARIES
      IF(JC(15))1001,1001,1002
 1002 CALL DIFUZ1(RZ2)
      F=F* BZ22/(RZ2**2)
      GØ TØ 1003
 1001 RZ2=BZ/2.0
 1003 WXL=X(IP)-RZ2
      WYT=Y(IP)+RZ2
      WYB=Y(IP)-RZ2
      WXR=X(IP)+RZ2
C
C     DØES WAFER (PARTIALLY) FALL IN LEFT BUFFER ZØNE...
      IF(X(IP)-X2)2,3,3
C     2=YES,ADJUST LEFT BØUNDARY AND SET NØL
 2    WXL=X2
      NØL=1+NBZX2
      GØ TØ 7
C     3=NØ,CØMPUTE NØL
C
C     NØL=SMALLEST X - INDEX ØF ANY GRID PT. WITHIN WAFER
 3    NØL=(WXL-X1)/DGX+1.0
C
C     DØES WAFER (PARTIALLY) FALL ØUTSIDE RIGHT BUFFER ZØNE
      IF(WXR-X4)4,4,6
C     4=NØ,CHECK IF GRID INTERVALS WERE ADJUSTED
 4    IF(NBZX+1)5,7,9
C     5=ERRØR
 5    IRRØR=5
      GØ TØ 333
 6    WXR=X4+.01*DGX
 7    JX=(WXR-X1)/DGX+1.0
      NWX=JX-NØL
C
C     ARE THERE ØUTPUT PTS TØ BE CØNSIDERED
      IF(NWX)777,777,10
 9    NWX=NBZX
C     NWX=NØ. ØF GRID PTS. CØVERED BY WAFER IN X DIRECTIØN
C
```

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```
C       DOES WAFER (PARTIALLY) FALL IN LOWER BUFFER ZONE...
        IF(WYB-YMIN) 11,12,12
C  11=YES, ADJUST LOWER BOUNDARY AND SET NOB
 11     WYB=YMIN
        NOB=1
        GO TO 1[illegible]
C  12=NO,COMPUTE NOB
C       NOB=SMALLEST Y - INDEX OF ANY GRID PT WITHIN WAFER
 12     NOB=(WYB-YMIN)/DGY+1.0
C
C       DOES WAFER (PARTIALLY FALL IN UPPER BUFFER ZØNE
        IF(WYT-YMAX)13,13,15
C  13=NØ,CHECK IF GRID INTERVALS WERE ADJUSTED
 13     IF(NBZY+1)14,16,16
C  14=ERRØR
 14     IRRØR=14
        GØ TØ 333
   15 WYT=YMAX
   16 JY=(WYT-YMIN)/DGY+1.0
C       NWY=NØ. ØF GRID PTS. CØVERED BY WAFER IN Y-DIRECTIØN
        NWY=JY-NØB
C
C       ARE THERE ØUTPUT PØINTS TØ BE CØNSIDERED
        IF(NWY)777,777,19
   18 NWY=NBZY
C
C   19=YES, CØMPUTE WAFER CØNTRIBUTIØN
C
   19 K=NØL+(NØB-1)*NXMAP
        MM=K+(NWY-1)*NXMAP
        NN=NWX-1
        DØ 20 J=K,MM,NXMAP
        JJ=NN+J
        DØ 20 I=J,JJ
        ØMA=ØMAP(I)
        GØ TØ NØRD, (211,212,213)
 211    IF(ØMA.EQ.0.0) GØ TØ 213
        ØMAP(I)=AMIN1 (ØMA,F)
        GØ TØ 20
 212    ØMAP(I)=AMAX1(ØMA,F)
        GØ TØ 20
 213    ØMAP(I)=ØMAP(I)+F
 20     CØNTINUE
  777 RETURN
  333 CALL ERRØR (PRØGRM,IRRØR,IØUT)
C
        STØP
        END
```

```
[illegible]
      [illegible]
      [illegible] 57
      [illegible] TECHNICAL OPERATIONS RESEARCH  SR  COUNT
C***** COMPUTING COUNT [illegible]
C***     JOUT          THE [illegible] DENSELY POPULATED REGION
C***     NSH           THE NUMBER OF PARTICLE PARAMETRS TO BE WRITTEN OUT
C***     KTAPE         THE TAPE NUMBER ON WHICH THESE PARTICLE PARAMETER
C***     ARE TO BE WRITTEN OUT.
C
C *************************************************************************
C
      COMMON /SET1/
     1          DIAM     ,DETID(12),IRISE   , IEXEC   , ISIN    , ISOUT   ,
     2          SD       , SPAR    , SSAM    , TME     , TMP1    , TMPL    ,
     3          T2M      , U*      , VPR     , W       , HBURST  , SCLDHB  ,
     4          TID(40)  , RMIN    , IDISTR  , SPAR1   , MRTAPE  , FSUM    ,
     5          SPAR4    , SPAR5   , SPAR6   , SPAR7   , SPAR8   , SPAR9
      COMMON  /SET3/
     1    BZ                 ,BZ2                ,BZZ             ,BZ22
     2    ,DELTAX            ,DGX                ,DGY             ,DIFCON
     3    ,DIFADJ            ,FMAS(500)          ,FMASS(200)      ,IC(18)
     4    ,ICON              ,ICTR               ,IH              ,IZT(18)
     5    ,IP                ,IPOUT              ,ITT(18)         ,IV
     6    ,JC(18)            ,JIN                ,JOUT            ,JPOUT
     7    ,KTR(500)          ,KTAPE              ,LAST            ,MAPRUN
     8    ,MARRAY            ,MIN                ,MXREQ
     9    ,N                 ,NA                 ,NBZX            ,NBZX2
     1    ,NBZY              ,NCL                ,NE              ,NF
     2    ,NIJ               ,NMAP               ,NMAX            ,NOX
     3    ,NP(21)            ,NREC               ,NS              ,NTAPES
     4    ,NTAPET            ,NTASK              ,NXMAP           ,NYMAP
     5    ,YMIN              ,PS(500)            ,PSIZE(200)      ,PACT(200)
     6    ,ROPART            ,SV(200)            ,T(500)          ,T1
     7    ,T2                ,TLIMIT             ,X(500)          ,XF
     8    ,X2                ,XMAX               ,XMIN            ,XNMAP
     9    ,X1                ,X2                 ,X3              ,X4
     1    ,Y(500)            ,YF                 ,Y2              ,YMAX
      COMMON /SET4/  OMAP(4000)
C
C *************************************************************************
C
      DATA PROGRM/6HCOUNT
C
C *************************************************************************
C *************************************************************************
C
      MAX=NP(1)+NP(2)
      JOUT=2
      IF (JIN.LT.4) GO TO 6
      DO 4 J=4,JIN,2
      IF(MAX-NP(J)) 3,4,4
    3 MAX=NP(J)
      JOUT=J
    4 CONTINUE
      IF(MAX-NP(1)-NP(2))5,6,7
 5    CALL ERROR(PROGRM,-5,ISOUT)
    6 NS=MAX+NP(3)
      GO TO 8
    7 NS=NP(JOUT)+NP(JOUT+1)
```

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```
8 JJ = JØUT/2
  KTAPE=IØT(JJ)
  RETURN
  END
```

```
$IBFTC CRDPX    LIST,DECK,M94/2
      SUBROUTINE CRDP
C     P. FLUSSER  TECHNICAL OPERATIONS RESEARCH  SK  CRDP
C
C   26FEB 67
C***AFTER ALL THE PARTICLE PARAMETERS HAVE BEEN READ FROM TAPE
C***IPOUT, SUBROUTINE CRDP IS CALLED AND WRITES OUT THOSE
C***PARTICLE PARAMETERS THAT ARE LEFT IN CORE ON THE APPROPRIATE
C***TAPES.   IT LEAVES THOSE PARTICLES THAT FALL INTO THE ZONE
C***WHICH IS TO BE TREATED NEXT IN CORE AND SETS NIJ=-1 AS A
C***SIGNAL TO SUBSEQUENTLY CALLED SUBROUTINES TO TREAT THESE
C***PARTICLES BEFORE READING NEW ZNES FROM TAPE.
C
C ***********************************************************************
C
      COMMON /SET1/
     1        DIAM    ,DETID(12),IRISE  , IEXEC  , ISIN   , ISOUT  ,
     2        SD      , SPAR    , SSAM   , TME    , TMP1   , TMP2   ,
     3        TOM     , U       , VPR    , W      , HBURST , CCLCHF ,
     4        TID(40) , RAL     , IDISTR , SPAR1  , MOTAPE , FSUM   ,
     5        SPAR4   , SPAR5   , SPAR6  , SPAR7  , SPAR8  , SPAR9
      COMMON  /SET3/
     1     BZ               ,BZ2              ,BZZ              ,BZ22
     2    ,DELTAX           ,DGX              ,DGY              ,DIFCON
     3    ,DIFADJ           ,FMAS(500)        ,FMASS(200)       ,IC(18)
     4    ,ICON             ,ICH              ,IH               ,IOT(18)
     5    ,IP               ,IPOUT            ,ITT(18)          ,IV
     6    ,JC(18)           ,JIN              ,JOUT             ,JPOUT
     7    ,KTP(500)         ,KTAPE            ,LAST             ,MAPRUN
     8    ,MARRAY           ,MIN              ,MXREQ
     9    ,N                ,NA               ,NBZX             ,NBZX2
     1    ,NBZY             ,NCL              ,NE               ,NF
     2    ,NIJ              ,NMAP             ,NMAX             ,NOX
     3    ,NP(21)           ,NREC             ,NS               ,NTAPES
     4    ,NTAPET           ,NTASK            ,NXMAP            ,NYMAP
     5    ,YMIN             ,PS(500)          ,PSIZE(200)       ,PACT(200)
     6    ,ROPART           ,SV(200)          ,T(500)           ,T1
     7    ,T2               ,TLIMIT           ,X(500)           ,XF
     8    ,X0               ,XMAX             ,XMIN             ,XNMAP
     9    ,X1               ,X2               ,X3               ,X4
     1    ,Y(500)           ,YF               ,Y0               ,YMAX
      COMMON /SET4/  OMAP(4000)
C
C ***********************************************************************
C
C
C ***********************************************************************
C ***********************************************************************
C
      K=JIN-2
C*** IS LAST ZONE SORTED... IF YES, WRITE OUT ALL ZONES,
C***IF NOT, TREAT LAST ZONE DIFFERENTLY.
      IF(LAST) 50,50,51
   50 K=K+2
 51   IF(K.LT.2) GO TO 52
      DO 1 J=2,K,2
      JOUT=J
      JJ=J/2
      KTAPE=IOT(JJ)
      IF(J-2)31,2,31
```

```
 31    NS=NP(J)+NP(J+1)
       IF(NS) 2,2,3
     3 CALL SHIFT
     2 L=0
       WRITE (KTAPE)L
     1 REWIND KTAPE
C***   IS LAST ZØNE WRITTEN ØUT...
 52    IF(LAST) 8,10,8
C***     CAN WE DUMP ALL PARTICLES NØW...
     8 IF(NP(JIN)-NMAX) 5,5,6
     6 NS=NMAX
       NP(JIN)=NP(JIN)-NS
       GØ TØ 7
     5 NS=NP(JIN)
     7 JØUT=JIN
       KTAPE=IØT(MIN)
       IF(NS)9,9,71
 71    CALL SHIFT
C***ARE ANY PARTICLES LEFT...
       IF(NP(JIN)) 9,9,8
     9 L=0
       WRITE (KTAPE)L
       REWIND KTAPE
    10 NIJ=-1
       RETURN
       END
```

```
$IBFTC DIFUXl   LIST,DECK,M94/2
      SUBRØUTINE DIFUZ1(RZ2)
C     T.W. SCHWENKE     TECHNICAL ØPERATIØNS RESEARCH
C     11 ØCT   66
C
C     THIS SUBRØUTINE EXPANDS THE CLØUD SUBDIVISIØNS AS A MEANS ØF
C     APPRØXIMATING THE EFFECTS ØF ATMØSPHERIC DIFFUSIØN.
C
C ***********************************************************************
C
      CØMMØN /SET1/
     1         DIAM    ,DETID(12),IRISE   , IEXEC   , ISIN    , ISØUT    ,
     2         SD      , SPAR    , SSAM    , TME     , TMP1    , TMP2     ,
     3         T2M     , U       , VPR     , W       , HBURST  , SCLDHB   ,
     4         TID(40), RMIN    , IDISTR  , SPAR1   , MBTAPE  , FSUM     ,
     5         SPAR4   , SUBRAD  , RADMAX  , XGZ     , YGZ     , TGZ
C
C ***********************************************************************
C
      CØMMØN  /SET3/
     1    BZ               ,BZ2              ,BZZ              ,BZ22
     2    ,DELTAX          ,DGX              ,DGY              ,DIFCØN
     3    ,DIFADJ          ,FMAS(500)        ,FMASS(200)       ,IC(18)
     4    ,ICØN            ,ICTR             ,IH               ,ICT(18)
     5    ,IP              ,IPØUT            ,ITT(18)          ,IV
     6    ,JC(18)          ,JIN              ,JØUT             ,JPØUT
     7    ,KTR(500)        ,KTAPE            ,LAST             ,MAPRUN
     8    ,MARRAY          ,MIN              ,MXREQ
     9    ,N               ,NA               ,NBZX             ,NBZX2
     1    ,NBZY            ,NCL              ,NE               ,NF
     2    ,NIJ             ,NMAP             ,NMAX             ,NØX
     3    ,NP(21)          ,NREQ             ,NS               ,NTAPES
     4    ,NTAPET          ,NTASK            ,NXMAP            ,NYMAP
     5    ,YMIN            ,PS(500)          ,PSIZE(200)       ,PACT(200)
     6    ,RØPART          ,SV(200)          ,T(500)           ,T1
     7    ,T2              ,TLIMIT           ,X(500)           ,XF
     8    ,XØ              ,XMAX             ,XMIN             ,XNMAP
     9    ,X1              ,X2               ,X3               ,X4
     1    ,Y(500)          ,YF               ,YØ               ,YMAX
C
C ****     **************************************************************
C
      CØMMØN /SET4/  ØMAP(4000)
C
C ***********************************************************************
C
C     THE VARIABLE DIFCØN HØLDS AT THIS PØINT THE PRØDUCT  3.0*DIFCØN
C     WHERE DIFCØN ØRIGINALLY WAS PUT IN AS AN ATMØSPHERIC DIFUSIØN
C     CØNSTANT.
C     BZ22 HAS THE SQUARE ØF BZ/2.0 ,THE WIDTH ØF THE CLØUD SUBDIVISIØN.
C
 1    FØRMAT(53H DIFFUSIVE GRØWTH ØF CLØUD SUBDIVISIØNS IS EXCESSIVE.,3X
     1,3HX= F11.3,3HY= F11.3)
C
C ***********************************************************************
C ***********************************************************************
C
      DATA NGØØF /0/
C
      RZ2=SQRT(DIFCØN*(T(IP)-TGZ)+BZ22)
```

```
IF(RZ2 .LE.BZ2)  RETURN
RZ2=BZ2
NG00F=NG00F+1
IF(NG00F .GT.0 .AND.NG00F  .LT.50) WRITE(IS0UT,1)X(IP),Y(IP)
RETURN
END
```

```
$IBFTC LETSG   LIST,DECK,M94/2
      SUBROUTINE LETSG?
C     26  FEB  67
C     P. FLUSSER  TECHNICAL ØPERATIØNS RESEARCH  SR  LETSGØ
C
C*** THIS SUBRØUTINE READS THE PARTICLE PARAMETERS FRØM TAPE IPØUT
C*** AND CALLS THE APPRØPRIATE SUBRØUTINES TØ PRØCESS THEM.
C*** SUBRØUTINES CALLED BY LETSGØ,...
C***PRØC,ZERØ,CØUNT,SHIFT,CRDP.
C***NE= NUMBER ØF EMPTY SPACES.
CG** MARRAY= DIMENSIØN ØF PARTICLE ARRAY
C*** NP(I)= NUMBER ØF PARTICLES FALLING IN ITH ZØNE
C*** KTR(I)= ZØNE INDENTIFICATIØN NUMBER ØF ITH PARTICLE
C*** NIJ= NØ. ØF PARTICLES IN NECT DATA BLØCK.
C
C ************************************************************************
C
      CØMMØN /SET1/
     1        DIAM   ,DETID(12),IRISE  , IEXEC  , ISIN   , ISØUT   ,
     2        SD     , SPAR   , SSAM   , TMZ    , TMP1   , TMP2    ,
     3        T2M    , U      , VPR    , W      , HBURST , SCLDHB  ,
     4        TID(40), RMIN   , IDISTR , SPAR1  , MBTAPE , FSUM    ,
     5        SPAR4  , SPAR5  , SPAR6  , SPAR7  , SPAR8  , SPAR9
      CØMMØN  /SET3/
     1    BZ            ,PZ2           ,BZZ           ,BZ22
     2   ,DELTAX        ,DGX           ,DGY           ,DIFCØN
     3   ,DIFADJ        ,FMAS(500)     ,FMASS(200)    ,IC(18)
     4   ,ICØN          ,ICTR          ,IH            ,IØT(18)
     5   ,IP            ,IPØUT         ,ITT(18)       ,IV
     6   ,JC(18)        ,JIN           ,JØUT          ,JPØUT
     7   ,KTR(500)      ,KTAPE         ,LAST          ,MAPRUN
     8   ,MARRAY        ,MIN           ,MXREQ
     9   ,N             ,NA            ,NBZX          ,NBZX2
     1   ,NBZY          ,NCL           ,NE            ,NF
     2   ,NIJ           ,NMAP          ,NMAX          ,NØX
     3   ,NP(21)        ,NRFQ          ,NS            ,NTAPES
     4   ,NTAPET        ,NTASK         ,NXMAP         ,NYMAP
     5   ,YMIN          ,PS(500)       ,PSIZE(200)    ,PACT(200)
     6   ,RCPART        ,SV(200)       ,T(500)        ,T1
     7   ,T2            ,TLIMIT        ,X(500)        ,XF
     8   ,XØ            ,XMAX          ,XMIN          ,XNMAP
     9   ,X1            ,X2            ,X3            ,X4
     1   ,Y(500)        ,YF            ,YØ            ,YMAX
      CØMMØN /SET4/  ØMAP(4000)
C
C ************************************************************************
C
      DATA PRØGRM/6HLETSGØ/
C
C ************************************************************************
C ************************************************************************
C
C
      NE=MARRAY
      K=JIN+1
      DØ 2 I=1,K
    2 NP(I)=0
      DØ 3 I=1,MARRAY
    3 KTR(I)=0
      ASSIGN 100 TØ NSN
    4 READ (IPØUT)NIJ
```

```
C*** ARE WE DØNE... 8=YES, 9=NØ.
      IF(NIJ) 5,8,9
 5    IRRØR=-5
 7734 CALL ERRØR(PRØGRM,IRRØR,ISØUT)
C***DUMP AND RETURN
    8 CALL CRØP
      GØ TØ 18
    9 IF(NIJ-MARRAY) 11,11,10
 10   IRRØR=-10
      GØ TØ 7734
C*** IS THERE ENØUGH RØØM TØ READ NEXT DATA BLØCK...
C*** 12= YES, PRØCEED, SHIFTING ZERØS IF NECESSARY.
   11 IF(NIJ-NE) 12,12,15
   12 GØ TØ NSN,(100,200)
  100 ASSIGN 200 TØ NSN
C*** 13= READ PARTICLE PARAMETERS DECREMENT EMPTY SPACES, PRØCESS
C***PARTICLES READ IN AND READ NUMBER ØF PARTICLES IN NEXT
C*** DATA BLØCK.
   13 READ (IPØUT)(X(I),Y(I),T(I),PS(I),FMAS(I),I=1,NIJ)
      NE=NE-NIJ
      CALL PRØC
      GØ TØ 4
  200 CALL ZERØ
      GØ TØ 13
   15 CALL CØUNT
      CALL SHIFT
      GØ TØ 11
   18 RETURN
      END
```

```
$IBFTC LNK8     LIST,DECK,M94/2
      SUBRØUTINE LINK8
C     T.W.SCHRENKE   TECHNICAL ØPERATIØNS RESEARCH    ØUTPUT PRØCESSØR  I
C     15 FEB 67
C     FIRST HALF ØF THE ØUTPUT PRØCESSØR
C     THIS PRØGRAM INITIALIZES AND WRITES HEADINGS FØR THE ØUTPUT
C     PRØCESSØR.  THEN IT CALLS THE FIRST PART ØF THE PARTICLE ACTIVITY
C     MØDULE (PAM1) TØ PRECØMPUTE DATA USED BY THE SECØND PART ØF THE
C     PARTICLE ACTIVITY MØDULE WHICH WILL BE CALLED DURING THE
C     EXECUTIØN ØF LINK9.
C
C *********************************************************************
C
C
      CØMMØN /SET1/
     1          DIAM    ,DETID(12),IRISE   , IEXEC   , ISIN    , ISØUT    ,
     2          SD      , SPAR    , SSAM    , TIME    , TMP1    , TMP2     ,
     3          T2A     , U       , VPR     , W       , HBURST  , SCLDHB   ,
     4          TID(40) , RMIN    , IDISTR  , SPAR1   , MBTAPE  , FSUM     ,
     5          SPAR4   , SUBRAD  , RADMAX  , X0Z     , Y0Z     , T0Z
      CØMMØN  /SET3/
     1     BZ               ,BZ2              ,B2Z              ,BZ22
     2    ,DELTAX           ,DGX              ,DGY              ,DIFCØN
     3    ,DIFADJ           ,FMAS(500)        ,FMASS(200)       ,IC(18)
     4    ,ICØN             ,ICTR             ,IH               ,IST(18)
     5    ,IP               ,IPØUT            ,ITT(18)          ,IV
     6    ,JC(18)           ,JIN              ,JØUT             ,JPØUT
     7    ,KTR(500)         ,KTAPE            ,LAST             ,MAPRUN
     8    ,MARRAY           ,MIN              ,MXREQ
     9    ,N                ,NK               ,NØZX             ,NØZX2
     1    ,NØZY             ,NCL              ,NE               ,NF
     2    ,NIJ.             ,NMAP             ,NMAX             ,NØX
     3    ,NP(21)           ,NREQ             ,NS               ,NTAPES
     4    ,NTAPET           ,NTASK            ,NXMAP            ,NYMAP
     5    ,YMIN             ,P3(500)          ,PSIZE(200)       ,PACT(200)
     6    ,RØPART           ,SV(200)          ,T(500)           ,T1
     7    ,T2               ,TLIMIT           ,X(500)           ,XF
     8    ,X0               ,XMAX             ,XMIN             ,XNMAP
     9    ,X1               ,X2               ,X3               ,X4
     1    ,Y(500)           ,YF               ,Y0               ,YMAX
      CØMMØN/ØUTPUT/
     1  . FISNUM           ,FP      (200)  ,FW                ,ITAB       ,JØB
     2    ,MASCHN           ,SIGMAS
C
C     DIMENSIØNS PECULIAR TØ LINK8
      DIMENSIØN            CRID(12)        ,SPID(12)          ,PSID(12)
     1    ,TØPID(12)        ,WID(12)
C
C********************************** GLØSSARY ***************************
C**********  FØR ADDITIØNAL GLØSSARY ITEMS SEE VØL. IV, SUBRØUTINE  ****
C**********  LINK5                                                  ****
C
C     BZ                    WIDTH ØF CLØUD WAFER AS FIRST READ
C     BZ2 = BZ/2 IS THE WIDTH ØF THE BUFFER ZØNE BETWEEN MAP ZØNES.
C     BZ22                  SQUARE ØF HALF THE CLØUD SUBDIVISIØN LENGTH
C     DELTAX                MAP ZØNE WIDTH EXCLUSIVE ØF BUFFER ZØNES
C     DGX, DGY - LENGTHS ØF GRID INTERVALS IN X AND Y DIRECTIØNS
C           RESPECTIVELY
C     DIFADJ                ADJUSTMENT FACTØR TØ ALLØW FØR DIFFUSIVE GRØWTH
C                           ØF CLØUD SUBDIVISIØNS.
```

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```
C       DIFCØN                 ATMØSPHERIC DIFFUSIØN CØNSTANT
C       GRUFF      A GRØUND RØUGHNESS FACTØR
C       HTST,DTST,PØUT        TEMPØRARY STØRAGE
C       IC(J)                  ØVERALL CØNTRØL VARIABLES
C       IC(17)  PØSITIVE MEANS STØP WITHØUT ENTERING ØUTPUT PRØCESSØR
C       IC(17) = 0 MEANS PRØCEED WITH JØB
C       IC(18) PØSITIVE MEANS PRINT TAPE IPØUT BEFØRE EXECUTIØN
C       IC(18) = 0 MEANS DØ NØT PRINT TAPE IPØUT
C       ICØN                   A RØUTE CØNTRØL PARAMETER
C       ICTR                   A CØNTRØL PARAMETER
C       IH,IV                  HØRIZØNTAL AND VERTICAL CHARACTER SPACINGS FØR
C                              THE PRINTER IN TERMS ØF CHARACTERS PER INCH
C       IØT(J)                 ID NUMBERS ØF AVAILABLE TAPE UNITS
C       IPØUT = JPØUT - TAPE ØN WHICH PARTICLE PARAMETERS ARE WRITTEN BY
C           THE TRANSPØRT PRØGRAM.
C       ISØUT                  SYSTEM ØUTPUT TAPE NUMBER
C       IRRØR                 ERRØR STØP TRACE WØRD
C       ISIN                   SYSTEM INPUT TAPE NUMBER
C       ITT(J)                 ID NUMBERS ØF AVAILABLE TAPE UNITS
C       JC(J)                  LØCAL CØNTRØL VARIABLES
C       JC(1) ... ØUTPUT FØRMAT CØNTRØL VARIABLE
C       =1     2 LINE E FØRMAT PRINTER MAP
C       =2     2 LINE F11.3 FØRMAT PRINTER MAP
C       =3       BINARY MULTIPLE BURST TAPE
C       JC(15)                 IF PØSITIVE CAUSES THE USE ØF AN ATMØSPHERIC
C                              DIFFUSIØN MØDEL
C       JC(16) = 0 .... ADJUST GRID INTERVALS TØ YIELD AN UNDISTØRTED MAP
C            HAVING A MINIMUM SCALE FACTØR BASED ØN DGX ØR DGY.
C       JC(18) = 0 .....     ADJUSTMENT ØF GRID INTERVALS PERMITTED
C       JC(18) = 1 .....     NØ ADJUSTMENT ØF GRID INTERVALS PERMITTED
C       JJ,NI                  TEMPØRARY STØRAGE
C       LAST                   =1 INDICATES A SUBSEQUENT SØRT IS REQUIRED
C       MARRAY = MAXIMUM NUMBER ØF WAFERS THAT CAN BE CØNSIDERED AT ØNE
C            TIME
C       MAPRUN = 0    ...    MAP CALLED FØR FIRST TIME
C       MAPRUN = +N   ...    MAP HAS PREVIØUSLY PRINTED N STRIPS ØF A MAP
C       MBTAPE                 MULTIPLE BURST TAPE NUMBER
C       MIN                    NUMBER ØF CLASSES USED FØR PARTICLE SØRT
C       MXREQ                  MAXIMUM NUMBER ØF PRØCESSING REQUEST TYPES
C                              ALLØWED FØR IN THE CØDE
C       NØZX = NUMBER ØF GRID PØINTS IN X DIRECTIØN ØF WAFER
C       NØZX2 = NØZX/2 = NUMBER ØF GRID PØINTS IN X DIRECTIØN ØF THE
C            BUFFER ZØNE.
C       NCL                    NUMBER ØF PARTICLE CLASSES
C       NID                    NUMBER ØF PARTICLE DESCRIPTIØNS IN THE CURRENT
C                              PARTICLE BLØCK
C       NMAP, XNMAP = NUMBER ØF ØUTPUT GRID PØINTS ØN ENTIRE MAP
C       NMAX = MAXIMUM NUMBER ØF WAFERS THAT SHØULD BE WRITTEN IN ØNE
C            BLØCK ØN THE TAPE CØNTAINING WAFERS THAT HAVE YET TØ BE
C            SØRTED.
C       NØL                    SMALLEST X INDEX ØF A MAP PØINT TØ THE RIGHT ØF
C                              THE LEFT BØUNDARY ØF THE CLØUD SUBDIVISIØN
C       NØX = NUMBER ØF GRID PØINTS IN X DIRECTIØN IN THE CØRE-LØAD MAP
C            WITHØUT BUFFER ZØNES.
C       NØX                    THE NUMBER ØF GRID INTERVALS IN DELTAX
C       NREG                   CØMPUTATIØN TYPE CØDE
C       NRQ                    A CØUNTER FØR MAP REQUESTS
C       NST                    TEMPØRARY STØRAGE ØF A DATA BLØCK CØUNT
C       NTAPES                 THE NUMBER ØF AVAILABLE TAPE UNITS
C       NTAPET                 THE NUMBER ØF AVAILABLE TAPE UNITS
```



```
C      NTASK         •        A SEQUENTIAL COUNTER FOR SPECIFICATIONS OF MAP
C             •               COORDINATES AND GRID INTERVALS
C      NXMAP = NUMBER OF GRID POINTS IN X DIRECTION IN THE CORE-LOAD MAP
C           COUNTING 2 BUFFER ZONES
C      NYMAP = NUMBER OF GRID POINTS IN Y DIRECTION IN THE CORE-LOAD MAP
C      NZ                     NUMBER OF MAP ZONES RIGHT OF 1ST MAP
C      EMAP(J)                THE MAP ARRAY
C      ØPID( )                ØUTPUT PRØCESSØR IDENTIFICATIØN
C      ØX                     THE FLØATING EQUIVALENT ØF NØX
C      TØPID( )               TØPØGRAPHY IDENTIFICATIØN
C      T1,T2                  REQUEST TIME ARGUMENTS
C      WID( )                 WIND FIELD IDENTIFICATIØN
C      X,Y,T,PS,ID            PARTICLE DESCRIPTIØN VARIABLES (INDEXED)
C      XMAX,XMIN              MAXIMUM AND MINIMUM X CØØRDINATES ØF THE MAP
C      XØ,YØ,XF,YF            LIMITING MAP CØØRDINATES TAKING INTØ ACCØUNT
C                             THE BØUNDARY BUFFER ZØNES
C      YMAX,YMIN              MAXIMUM AND MINIMUM Y CØØRDINATES ØF THE MAP
C
C
C ******************************************************************************
C
 1     FØRMAT(12A6)
 2     FØRMAT(15X,16I4)
 3     FØRMAT(//36H PLEASE REPLACE THE REEL ØN LØGICAL I5,19H WITH A BLANK
      1K TAPE                  /////1H0)
 5     FØRMAT(A6,I5,5E12.5)
 6     FØRMAT(29H0 WRØNG TAPE REEL ØN DRIVE   I2)
 7     FØRMAT(46H0PLEASE MØUNT THE CØRRECT TAPE AND PRESS START)
 8     FØRMAT(1X71H
      1 )
 9     FØRMAT(6F10.3)
 10    FØRMAT(////29X,65H****  SUMMARY ØF INPUT IDENTIFIERS AND INITIAL CLØUD
      1CØNDITIØNS  ****///25X43H****  ØUTPUT PRØCESSØR IDENTIFICATIØN  ***
      2*/25X,12A6///25X,56H****  INITIAL CØNDITIØNS (FIREBALL) IDENTIFICA
      3TIØN  ****/25X,12A6///25X,37H****  CLØUD RISE IDENTIFICATIØN  ***
      4/25X,12A6///25X,49H****  PARTICLE SET EXPANSIØN IDENTIFICATIØN  *
      5***,      /25X,12A6///25X,36H****  TRANSPØRT IDENTIFICATIØN  ****/25
      6X,12A6//25X31H****  WIND IDENTIFICATIØN  ****/25X,12A6///25X,37H**
      7**  TØPØGRAPHY IDENTIFICATIØN  ****/25X,12A6)
 11    FØRMAT(//15X24HTRANSPØRT IDENTIFICATIØN//25X,12A6)
 12    FØRMAT(//25X,24H****  ØTHER INPUTS  ****)
 15    FØRMAT(16I4)
 13    FØRMAT(/15X,26HTHE DIFFUSIØN CØNSTANT IS F12.5)
 16    FØRMAT(/15X77H****  THE CØNTRØL VARIABLE ARRAY, IC(J), WAS GIVEN T
      1HE FØLLØWING VALUES  ****)
 19    FØRMAT(//15X54HTHE FØLLØWING LØGICAL TAPES ARE AVAILABLE FØR SØRTI
      1NG.)
 21    FØRMAT(//15X43HPRINTER DESCRIPTIØN  -  CHARACTERS PER INCH)
 22    FØRMAT(16X,10HHØRIZØNTALI5,10X,10HVERTICAL  I3)
 26    FØRMAT(15X1HX,19X1HY,19X1HT,18X2HPS,19X4HMASS)
 28    FØRMAT(1H1///51X19H* * * * * * * * * *//12X101HT H E   D E P A R T
      1 M E N T   Ø F   D E F E N S E   F A L L Ø U T   P R E D I C T I Ø
      2 N   S Y S T E M,//51X,19H* * * * * * * * * *///48X,23HØUTPUT PRØ
      3CESSØR MØDULE///55X,11HPREPARED BY/43X,34HTECHNICAL ØPERATIØNS RES
      4EARCH,INC./52X,17HBURLINGTØN, MASS.)
 29    FØRMAT( ///45X29HLISTING ØF GRØUNDED PARTICLES)
 30    FØRMAT(//10X6HBLØCK I4)
 35    FØRMAT(I5)
 36    FØRMAT(5F20.4)
 37    FØRMAT(36HNØ. ØF PARTICLES IN THIS BLØCK IS  I4)
```

```
 99   FORMAT(33H NO REQ. THIS JOB, JUST TAPE DUMP)
C
C************************ BEGINNING OF PROGRAM ****************************
C ************************************************************************
C
      LOGICAL SKIP
      DATA PROGRM,HTST/6H LINK8,6HIPOUT
C
C ************************************************************************
C
      MSTAPE=11
      KOUT=ISOUT
      DIFADJ=3.0
      IPOUT=9
      JPOUT=IPOUT
      MXREG=20
      MARRAY=500
      NMAX=500
      NMAP=4000
      XNMAP=NMAP
      NTASK=0
C     CHECK IDENTIFICATION OF IPOUT
 102  REWIND IPOUT
      READ (IPOUT)POUT
      DTST=AND(POUT,COMPL(HTST))
      IF(DTST)100,101,100
 100  PRINT 6,IPOUT
      WRITE (ISOUT,6)IPOUT
      WRITE (ISOUT,7)
      PRINT 7
      PAUSE
      GO TO 102
 101  READ(IPOUT)FW,GGAM,GLDTMP,TMSD,SIGMA,TW,HOB,NCL,TLIMIT,BZ,ROPART,
     1 XGZ,YGZ,TGZ,RADMAX
      SIGMAS=.5*(SIGMA**2)
C
C     PRECOMPUTATION FOR DIFFUSION MODEL
      SUBRAD=BZ/2.0-RADMAX
      RADMAX=RADMAX**2
C
C     READ PREVIOUS IDENTIFIERS FROM GROUNDED PARTICLES TAPE
      READ (IPOUT) (DETID(J),J=1,12),(CRID(J),J=1,12),(PSEID (J),J=1,12)
     1,(TID(J),J=1,12),(XID(J),J=1,12)
      READ (IPOUT)NPS
      READ(IPOUT)(PSIZE(J),FMASS(J),PACT(J),SV(J),J=1,NPS)
      READ (IPOUT)(TOPID(J),J=1,12)
C
C     READ IDENTIFIER FOR OUTPUT PROCESSOR RUN
      READ (ISIN,1)(OPID(J),J=1,12)
C
C
C     READ LIST OF AVAILABLE TAPES
      READ (ISIN,15)(IOT(J),J=1,18)
C     TEST TO REMOVE OTHER PROGRAM TAPES
      NTAPES=18
      DO 103 J=1,18
      IF(IOT(J))108,105,106
 106  IF(IOT(J)-IPOUT)107,108,107
 107  IF(IOT(J)-ISOUT)109,108,109
 109  IF(IOT(J)-ISIN)103,108,103
```

```
 108   IØT(J)=0
 105   NTAPES=NTAPES-1
 103   CØNTINUE
       NTAPET=NTAPES
C
C      NØW CØNSØLIDATE IN THE ARRAY
       JB=1+NTAPES
       DØ 104 J=1,NTAPES
       IF(IØT(J))104,111,104
 111   IF(IØT(JB))112,112,113
 113   IØT(J)=IØT(JB)
       JB=JB+1
       GØTØ 104
 112   JB=JB+1
       GØ TØ 111
 104   ITT(J)=IØT(J)
C
C      READ CØNTRØL VARIABLE ARRAY
       READ (ISIN,15)(IC(J),J=1,16)
C
       READ (ISIN,9)DIFCØN
C      THIS PART ØF THE CØDE DUMPS TAPE IPØUT IF REQUIRED
C      IC(18) PØSITIVE MEANS DUMP TAPE IPØUT BEFØRE EXECUTIØN
C      IC(18) = 0 MEANS DØ NØT DUMP TAPE IPØUT
       IF(IC(18)) 500,5021,502
 500   IRRØR=-500
       GØ TØ 333
 502   SKIP=.FALSE.
       WRITE (ISØUT,28)
       WRITE (ISØUT,29)
       WRITE (ISØUT,11)(TID(J),J=1,12)
 5021  SKIP=.TRUE.
       NST=0
  600  READ (IPØUT)NIJ
       NST=NST+1
       IF(NIJ) 503,501,504
 503   IRRØR=-503
       GØ TØ 333
  504  READ (IPØUT)(X(I),Y(I),T(I),PØ(I),FMAS(I),I=1,NIJ)
       IF(SKIP) GØ TØ 600
       WRITE (ISØUT,30)NST
       WRITE (ISØUT,37)NIJ
       WRITE (ISØUT,26)
       WRITE (ISØUT,36)(X(I),Y(I),T(I),PØ(I),FMAS(I),I=1,NIJ)
       GØ TØ 600
 501   CØNTINUE
C      IC(17)  PØSITIVE MEANS STØP WITHØUT ENTERING ØUTPUT PRØCESSØR
C      IC(17) = 0 MEANS PRØCEED WITH JØB
  505  IF(IC(17)) 506,511,510
 506   IRRØR=-506
 333   CALL ERRØR (PRØGRM,IRRØR,ISØUT)
  510  WRITE (ISØUT,39)
       STØP
C      END ØF TAPE IPØUT DUMP
C
 511   CØNTINUE
C
C      READ PRINTER DESCRIPTIØN - CHAR/INCH HØRIZØNTAL  VERTICAL
 5111  READ (ISIN,15)IH,IV
C      PRINT A HEADING TØ IDENTIFY PRINTED ØUTPUT
```

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```
      WRITE (ISØUT,28)
      WRITE (ISØUT,10) (ØPID(J),J=1,12),(DLTID(J),J=1,12),(CRID(J),J=1,1
     12),(PSEID(J),J=1,12),(TID(J),J=1,12),(WID(J),J=1,12),(TØPID(J),J=1
     2,12)
      WRITE (ISØUT,12)
      WRITE (ISØUT,16)
      WRITE (ISØUT,2)(IC(J),J=1,18)
      WRITE (ISØUT,19)
      WRITE (ISØUT,2)(IØT(J),J=1,18)
      WRITE (ISØUT,21)
      WRITE (ISØUT,22)IH,IV
      WRITE (ISØUT,13)DIFCØN
C
C     PERFØRM PRECØMPUTATIØN FØR DIFFUSIØN MØDEL
      DIFCØN   =J*DIFCØN
C
      CALL PAM1
     1     (H2B     ,SLDTMP ,TMSD    ,TW
     2     ,ISIN    ,ISØUT  ,IPØUT   ,SIGMA )
  117 RETURN
      END
```

```
$IBFTC LNK9     LIST,DECK,M94/2
      SUBRØUTINE LINK9
C      26 FEB 67
C     SECØND HALF ØF THE ØUTPUT PRØCESSØR
C     SUBRØUTINES CALLED
C     MAP
C     RUN1
C     SLIDE
C     LETSGØ
C     SHIFT
C     CALC
C     CRØP
C     ZERØ
C     PRØC
C     CØUNT
C
C ***********************************************************************
C
      CØMMØN /SET1/
     1          DIAM    ,SETID(12),IRISE   , ILXEC   , ISIN    , ISØUT    ,
     2          SD      , SPAR    , SSAF    , TME     , TMP1    , TMP2     ,
     3          T2M     , U       , VPR     , W       , HBURST  , SCLØMB   ,
     4          TID(40) , RMIN    , IDISTR  , SPAR1   , BSTAPE  , FSØM     ,
     5          RUFSAM  , SURRAD  , RADMAX  , XGZ     , YGZ     , TGZ
      CØMMØN  /SET3/
     1     BZ              ,BZ2             ,BZZ             ,B222
     2    ,DELTAX          ,DGX             ,DGY             ,DIFCØN
     3    ,DIFADJ          ,FMAS(500)       ,FMASS(200)      ,IC(18)
     4    ,ICØN            ,ICTR            ,IH              ,IØT(18)
     5    ,IP              ,IPØUT           ,ITT(18)         ,IV
     6    ,JC(18)          ,JIN             ,JØUT            ,JPØUT
     7    ,KTR(500)        ,KTAPE           ,LAST            ,MAPRUN
     8    ,MARRAY          ,MIN             ,MXREW
     9    ,N               ,NA              ,NBZX            ,NBZX2
     1    ,NBZY            ,NCL             ,NE              ,NF
     2    ,NIJ             ,NMAP            ,NMAX            ,NØX
     3    ,NP(21)          ,NREG            ,NS              ,NTAPES
     4    ,NTAPET          ,NTASK           ,NXMAP           ,NYMAP
     5    ,YMIN            ,PS(500)         ,PSIZE(200)      ,PACT(200)
     6    ,RØPART          ,SV(200)         ,T(500)          ,T1
     7    ,T2              ,TLIMIT          ,X(500)          ,XF
     8    ,XØ              ,XMAX            ,XMIN            ,XNMAP
     9    ,X1              ,X2              ,X3              ,X4
     1    ,Y(500)          ,YF              ,YØ              ,YMAX
      CØMMØN/ØUTPUT/
     1     FISNUM         ,FP     (200) ,FØ              ,ITAB          ,JGØ
     2    ,MASCHN         ,SIGMAS
      CØMMØN/DECAY/
     1     IGØ            ,JD             ,KDØS           ,TENTER
     2    ,TEXIT          ,TIME
C
      CØMMØN /SET4/  ØMAP(4000)
C
C ***********************************************************************
C
 1    FØRMAT(12A6)
 2    FØRMAT (//15X,23HSUM ØF MAP ØRDINATES = E13.6 )
 3    FØRMAT(1H1////54X,11H* * * * * *)
 4    FØRMAT (//15X,23HGRØUND RØUGHNESS FACTØR F10.3 )
 9    FØRMAT(7F10.3)
```

```
15    FØRMAT(18I4)
17    FØRMAT(32H OUTPUT PROCESSING IS COMPLETED.)
23    FØRMAT(1H1///39X27H****  OUTPUT PROCESSOR TASKI5,6H  ****)
24    FØRMAT(///15X25HGRID LIMITS AND INTERVALS/18X4HXMIN10X4HXMAX10X4HY
     1MIN10X4HYMAX10X7HDELTA X10X7HDELTA Y/15XF10.0,4XF10.0,4XF10.0,4XF1
     20.0,5XF10.1,5XF10.1)
25    FØRMAT(//15X71HTHE CONTROL VARIABLE ARRAY, JC(J), HAS BEEN GIVEN T
     1HE FØLLØWING VALUES./15X18I4)
27    FØRMAT(/15X32HMAPPED ØN GRID INTERVALS  DGX = F10.1,7H   DGY=F10.
     11)
31    FØRMAT(117H0INADEQUATE PRINTER DESCRIPTION. AN UNDISTORTED MAP CAN
     1NØT BE GUARANTEED. THIS RUN WAS CONTINUED WITH GRID INTERVALS /5X5
     23H ADJUSTED FØR MAXIMUM EFFICIENCY.)
32    FØRMAT(I4,2F10.3 ,I4)
33    FØRMAT(25H0UNACCEPTABLE REQUEST ...I4)
34    FØRMAT(//////15X,15HREQUEST NUMBER I4///15X,5HTYPE I4,10X5HT1 = F1
     10.1,10X,5HT2 = F10.1,10X,9HMASCHN = I4)
35    FØRMAT(I5)
C
C ************************************************************************
C ************************************************************************
C
      DATA PRØGRM  /6H LINK9/
      LOGICAL JD,KDØS,IGØ
C
      IGØ=.TRUE.
      NUL=0
      FSUM=0.0
 119  IF(FSUM.EQ.0.0)  GØ TØ 1191
      WRITE(ISØUT,2) FSUM
      FSUM=0.0
C
C1191 READ LIMITS ØN AREA ØF INTEREST
 1191 READ (ISIN,9) XMAX,XMIN,YMAX,YMIN,DGX,DGY,GRUFF
      IF (GRUFF.EQ.0.0)  GRUFF = 1.0
      IF(DGX+DGY)120,120,121
 120  WRITE (ISØUT,17)
      REWIND IPØUT
      PRINT 17
      STØP
C
C     READ ØTHER SPECIFIC INPUT
 121  READ (ISIN,15)(JC(J),J=1,18)
      NTASK=NTASK+1
      NRQ=0
C
C     CHECK PRINTER DESCRIPTIØNS
      NI=IH*IV
      IF(NI)601,601,122
 601  JC(16)=1
      WRITE (ISØUT,31)
C
C 122  WRITE  A LØCAL HEADING
 122  WRITE (ISØUT,23)NTASK
      WRITE (ISØUT,24)XMIN,XMAX,YMIN,YMAX,DGX,DGY
      WRITE (ISØUT,25)(JC(J),J=1,18)
      WRITE (ISØUT,4)  GRUFF
      GØ TØ 1209
C
 1211 IF(JC(1).EQ.3) WRITE (MBTAPE)NUL,NUL
```

```
C
 1209 IF (FSUM.EQ.0.0) GØ TØ 1219
      WRITE (ISØUT,2) FSUM
C 1219 READ A REQUEST FØR PRØCESSING
 1219 READ (ISIN,32)NREQ,T1,T2,MASCHN
      IF(MASCHN.EQ.0.AND.NREQ.NE.10)GØ TØ 1210
      IF(MASCHN.GT.71.AND.MASCHN.LT.162) GØ TØ 1210
      CALL ERRØR(PRØGRM,1209,ISØUT)
      MASCHN=95
 1210 DØ 935 I=1,NMAP
  935 ØMAP(I)=0.0
      DØ 936 I=1,MARRAY
      X(I)=0.0
 936  Y(I)=0.0
      ICØN=0
      MAPRUN=0
      NRQ=NRQ+1
      FSUM = 0.0
      NTAPES=NTAPET
      DØ 937 I=1,NTAPET
 937  IØT(I)=ITT(I)
C
C     IS NREQ AN ACCEPTABLE REQUEST
C     NØ TØ 1215
      IF(NREQ)1212,1212,1213
 1213 IF(NREQ-MXREQ)1214,1214,1215
 1215 WRITE (ISØUT,33)NREQ
      GØ TØ 1209
C
C     MXREQ IS MAXIMUM NUMBER ØF CALCULATIØN CØDES ALLØWED FØR IN CALC.
C 1212 NØ MØRE REQUESTS. PREPARE TØ RETURN TØ READ LØCAL DATA.
 1212 CØNTINUE
      GØ TØ 119
 1214 IPØUT=JPØUT
      REWIND IPØUT
      READ(IPØUT)TST
      READ (IPØUT)(TST,J=1,15)
      READ(IPØUT)(DETID(J),J=1,12),(DETID(J),J=1,12),(DETID(J),J=1,12),
     1(DETID(J),J=1,12),(DETID(J),J=1,12)
      READ(IPØUT)NPS
      READ(IPØUT)(PSIZE(J),FMASS(J),PACT(J),SV(J),J=1,NPS)
      READ(IPØUT)(DETID(J),J=1,12)
      IF(NRQ-1)1221,1222,1222
 1221 WRITE (ISØUT,3)
 1222 WRITE (ISØUT,34)NRQ,NREQ,T1,T2,MASCHN
      RUFSAM = SSAM/GRUFF
      JGØ=1
      ITAB=NPS
      FISNUM=FW*1.45E15
      IF(NREQ.EQ.15.ØR.NREQ.EQ.16) GØ TØ 1223
      T1=TIMSEC(T1,3,0)
      T2=TIMSEC(T2,3,0)
 1223 TIME=T1-TGØ
      TENTER=TIME
      TEXIT=T2-TGØ
      JD=.TRUE.
      KDØS=.FALSE.
      GØ TØ (80,81,79,78,82,80,80,82,78,83,80,80,80,80,80,81,80,80,80,80
     1),NREQ
 81   TIME=3600.0
```

```
      GO TO 79
   82 KDOS=.TRUE.
      GO TO 78
   83 JGO=2
      FISNUM=FISNUM*1.E+4
      RUFSAM=SSAM
      GO TO 79
   78 JD=.FALSE.
      FISNUM=FISNUM*3600.
   79 CALL PAM2
   80 CONTINUE
C
C     INITIALIZE FOR PROCESSING
      ICTR=0
      BZ2=BZ*0.5
      BZ22=BZ2*BZ2
C
C     IS USE OF DIFFUSION MODEL REQUESTED.  YES TO 1218
      IF(JC(15))1217,1217,1218
C
C1218 ADJUST BUFFER ZONE WIDTH TO ALLOW FOR FORTHCOMING DIFFUSIVE GROWTH
C     OF CLOUD SUBDIVISIONS.
 1218 BZ2=BZ2*DIFADJ
C
C1217 IS A GRID INTERVAL ADJUSTMENT PERMITTED      YES TO 130
 1217 IF(JC(18)-1)130,131,130
C
C     NO ADJUSTMENT PERMITTED OPTION
  131 NBZX=-1
      NBZY=-1
      NBZX2=BZ2/DGX+1.0
 1311 TST=NBZX2
      BZ2=TST*DGX
C     THE BUFFER ZONE IS NOW AN INTEGRAL NUMBER OF GRID INTERVALS WIDE
      GO TO 140
C
C 130   IS AN UNDISTORTED MAP DESIRED     YES TO 1302
  130 IF(JC(16))1301,1302,1301
 1302 DISY=IV
      DISX=IH
      RD=2.0*DISY/DISX
      DISX=RD*DGY
      IF(DISX-DGX)1303,1304,1304
 1303 DGX=DISX
 1304 DGY=DGX/RD
      GO TO 131
 1301 IF(JC(15).GT.0 ) GO TO 131
C
C     EFFICIENCY ADJUSTMENT
      NBZX=BZ/DGX
      TST=NBZX
      TST=TST*DGX
      IF(BZ-TST)133,1361,1361
 1361 IF(NBZX)133,136,134
  136 NBZX=-1
      NBZX2=1
      GO TO 137
  133 IRROR=-133
      GO TO 333
C
```

```
C 134 ADJUST DGX TØ MAKE BZ AN INTEGRAL MULTIPLE ØF IT.
 134  NBZX=NBZX+1
      TST=NBZX
      DGX=BZ/TST
 1341 NBZX2=(NBZX+1)/2
C
C     NØW FØR THE Y DIMENSIØN
 137  NBZY=BZ/DGY
      TST=NBZY
      TST=TST*DGY
      IF(BZ-TST) 135,1311,1371
 1371 IF(NBZY)135,138,139
 135  IRRØR=-135
      GØ TØ 333
 138  NBZY=-1
      GØ TØ 1311
 139  NBZY=NBZY+1
      TST=NBZY
      DGY=BZ/TST
      GØ TØ 1311
C
 140  XØ=XMIN-BZ2
      YØ=YMIN-BZ2
      XF=XMAX+BZ2
      YF=YMAX+BZ2
C
C     PREPARE TØ PRØCESS ØUTPUT
C*******CALCULATE NUMBER ØF ZØNES BEYØND FIRST NEEDED IN SØRTING
      NYMAP = (YMAX - YMIN)/DGY
      NXMAP=(XF-XØ)/DGX
      NST = NMAP/NYMAP
      IF(NXMAP-NST) 1503,1503,1402
 1402 NXMAP=NST
      XMAP=NXMAP
      ZZ=(XF-XØ)/(XMAP*DGX)
      NZ=ZZ
      TST=NZ
      IF(ZZ-TST) 1500,1501,1401
 1500 IRRØR=-1500
      GØ TØ 333
 1501 NZ=NZ-1
      GØ TØ 1401
 1503 NZ=0
C
C******** END ØF ZØNE CALCULATIØN
 1401  NØX=NXMAP-NBZX2-NBZX2
      IF(NØX)1403,1403,1404
 1403 IRRØR=-1403
 333  CALL ERRØR (PRØGRM,IRRØR,ISØUT)
      GØ TØ 1211
 1404 ØX=NØX
      DELTAX=ØX*DGX
C
 1502 WRITE(ISØUT,27)DGX,DGY
C
      X1=XØ
      X2=X1+BZ2
      X3=X2+DELTAX
      X4=X3+BZ2
 300  IF(NZ-NTAPES) 200,200,201
```

```
200   MIN=NZ
      LAST=0
      GØ TØ 202
201   MIN=NTAPES
      LAST=1
202   JIN=2*MIN
      IF(NZ)203,204,205
203   IRRØR=-203
      GØ TØ 333
204   CALL RUN1
      CALL MAP
      GØ TØ 1211
205   IF(LAST)206,207,209
206   IRRØR=-206
      GØ TØ 333
207   CALL LETSGØ
      ICTR=1
      DØ 208 INDEX=1,MIN
      CALL MAP
      IPØUT=IØT(INDEX)
      X1=X3
      X2=X4
      X3=X4+DELTAX
      X4=X3+BZ2
      CALL SLIDE
      CALL RUN1
208   REWIND IPØUT
      CALL MAP
      GØ TØ 1211
209   CALL LETSGØ
      KIN2=IPØUT
      ICTR=1
      KIN=MIN-1
      DØ 210 INDEX=1,KIN
      CALL MAP
      IPØUT=IØT(INDEX)
      X1=X3
      X2=X4
      X3=X4+DELTAX
      X4=X3+BZ2
      CALL SLIDE
      CALL RUN1
210   REWIND IPØUT
      CALL MAP
      IPØUT=IØT(MIN)
      IF(ICØN)2111,2112,2111
2112  NTAPES=NTAPES-1
      ICØN=1
      GØ TØ 2113
2111  IØT(MIN)=KIN2
2113  REWIND IPØUT
      NZ=NZ-MIN
      X1=X3
      X2=X4
      X3=X2+DELTAX
      X4=X3+BZ2
      CALL SLIDE
      GØ TØ 300
      END
```

```
$IBFTC MAPX     LIST,DECK,M94/2
      SUBROUTINE MAP
C     26  FEB  67
C     T.W.SCHWENKE   TECHNICAL ØPERATIØNS RESEARCH   SR MAP
C
C ***********************************************************************
C
      CØMMØN /SET1/
     1          DIAM     ,DETID(12),IRISE   , IEXEC   , ISIN    , ISØUT     ,
     2          SD       , SPAR    , SSAM    , TME     , TMP1    , TMP2      ,
     3          T2M      , U       , VPR     , W       , MBURST  , SCLDMB    ,
     4          TID(40), RMIN      , IDISTR  , SPAR1   , MBTAPE  , FSUM      ,
     5          SPAR4    , SPAR5   , SPAR6   , XGZ     , YGZ     , TGZ
      CØMMØN  /SET3/
     1   BZ              ,BZ2             ,BZZ             ,BZ22
     2   ,DELTAX         ,DGX             ,DGY             ,DIFCØN
     3   ,DIFADJ         ,FMAS(500)       ,FMASS(200)      ,IC(18)
     4   ,ICØN           ,ICTR            ,IH              ,IØT(18)
     5   ,IP             ,IPØUT           ,ITT(18)         ,IV
     6   ,JC(18)         ,JIN             ,JØUT            ,JPØUT
     7   ,KTR(500)       ,KTAPE           ,LAST            ,MAPRUN
     8   ,MARRAY         ,MIN             ,MXREQ
     9   ,N              ,NA              ,NBZX            ,NBZX2
     1   ,NBZY           ,NCL             ,NE              ,NF
     2   ,NIJ            ,NMAP            ,NMAX            ,NØX
     3   ,NP(21)         ,NREQ            ,NS              ,NTAPES
     4   ,NTAPET         ,NTASK           ,NXMAP           ,NYMAP
     5   ,YMIN           ,PS(500)         ,PSIZE(200)      ,PACT(200)
     6   ,RØPART         ,SV(200)         ,T(500)          ,T1
     7   ,T2             ,TLIMIT          ,X(500)          ,XF
     8   ,XØ             ,XMAX            ,XMIN            ,XNMAP
     9   ,X1             ,X2              ,X3              ,X4
     1   ,Y(500)         ,YF              ,YØ              ,YMAX
      CØMMØN /SET4/  ØMAP(4000)
      DIMENSIØN JMAP(20)
C
C ***********************************************************************
C
 1    FØRMAT(1H1,5HSTRIP13)
 2    FØRMAT(/1X,19I6)
 3    FØRMAT(15X21HTWØ-LINE E FØRMAT MAP)
 4    FØRMAT(5X,19F6.3)
 5    FØRMAT(15X26HTWØ-LINE F11.3 FØRMAT MAP.)
 6    FØRMAT(16HODISPLAY METHØD I4,33H IS NØT AVAILABLE. USED METHØD 1.)
 7    FØRMAT(//15X,28HTHE ØUTPUT PRESENTATIØN IS A)
 8    FØRMAT(//15X,25HTHE QUANTITY PRESENTED IS)
 9    FØRMAT(15X,27HA CØUNT ØF GRØUNDED WAFERS.)
10    FØRMAT(15X,38HDØSE RATE NØRMALIZED TØ TIME H+1 HØUR.)
11    FØRMAT(15X,29HDØSE RATE AT TIME H+F10.1,9H SECØNDS.)
12    FØRMAT(15X,32HDØSE ACCUMULATED BETWEEN TIME H+F10.1,22H SECØNDS AN
     1D INFINITY.)
13    FØRMAT(15X,32HDØSE ACCUMULATED BETWEEN TIME H+F10.1,12H AND TIME H
     1+F10.1,9H SECØNDS.)
14    FØRMAT(15X,34HTØTAL MASS ØF DEPØSITED PARTICLES.)
15    FØRMAT(15X,44HTØTAL PARTICLE MASS DEPØSITED BETWEEN TIMES F10.1,5H
     1 AND F10.1,9H SECØNDS.)
16    FØRMAT(/1X,F7.0,3X,2(10X,5H*****,F12.0,3X),20X,5H*****,/)
17    FØRMAT(15X,41HASSUMES ALL PARTICLES ARE GRØUNDED BY T1.)
18    FØRMAT(15X,17HACTIVITY AT TIME F10.1,19H DUE TØ MASS CHAIN I4)
19    FØRMAT(15X,26HMULTIPLE BURST BINARY TAPE)
```

```
 20   FORMAT(15X,31HGROUND ZERO IS LOCATED AT  X = F10.1,8H   , Y = F10.1
     1)
 21   FORMAT(1H1,41X,36HY-COORDINATE SCALES FOR SIDES OF MAP/1H0)
 22   FORMAT(//1X,F13.0,82X,F13.0)
 23   FORMAT(15X,46HTIME (SECONDS) OF ONSET OF FALLOUT DEPOSITION.)
 24   FORMAT(15X,50HTIME (SECONDS) OF CESSATION OF FALLOUT DEPOSITION.)
 25   FORMAT(15X,50HDIAMETER (MICRONS) OF SMALLEST DEPOSITED PARTICLE.)
 26   FORMAT(15X,49HDIAMETER (MICRONS) OF LARGEST DEPOSITED PARTICLE.)
 27   FORMAT(15X,58HMASS DEPOSITED (KGM/M**2) BY PARTICLES IN THE SIZE R
     1ANGE  ,F12.5,4H TO ,F12.5, 9H MICRONS.)
 28   FORMAT(15X,73HH+1 HOUR NORMALIZED DOSE RATE RESULTING FROM PARTICL
     1ES IN THE SIZE RANGE ,F12.5,4H TO ,F12.5,9H MICRONS.)
C
C ***********************************************************************
C ***********************************************************************
C
      DATA BITLUM,INC,LREW/ 6HMULTIB,19,0/
C
      IF(MAPRUN) 101,100,101
 100  TINC=5.0*DGX
      XCOORD=XMIN+DGX
      VINC=INC
      XCINC=VINC*DGX
      KKL=NBZX2+1
      NX=NXMAP-NBZX2-NBZX2
C     LEFT IS USED HERE AS A TEMPORARY STORAGE
      LEFT=(XMAX-X2)/DGX
C     PRINT MAP TITLE
      WRITE (ISOUT,7)
C     SELECT APPROPRIATE DISPLAY OPTION CODE
      IF(JC(1))147,147,131
 131  IF(JC(1)-6)132,132,147
 130  JC(1)=1
 132  N1=JC(1)
      GO TO (141,142,143,144,145,146),N1
 141  ASSIGN 150 TO N2
      WRITE (ISOUT,3)
      GO TO 102
 142  ASSIGN 151 TO N2
      WRITE (ISOUT,5)
      GO TO 102
 143  WRITE(ISOUT,19)
      ASSIGN 301 TO N2
      IF(LREW.NE.0) GO TO 1431
      LREW=1
      REWIND MBTAPE
 1431 WRITE (MBTAPE)BITLUM
      WRITE(MBTAPE)XMIN,XMAX,YMIN,YMAX,DGX,DGY
      GO TO 102
C
C************************ CODE INSERTION POINTS *************************
 144  CONTINUE
 145  CONTINUE
 146  CONTINUE
C************************ CODE INSERTION POINTS *************************
C
 147  WRITE (ISOUT,6)N1
      GO TO 130
 101  KKL=1
      NX=NXMAP-NBZX2
```

```
C     LEFT IS USED HERE AS A TEMPORARY STORAGE
      LEFT=(XMAX-X1)/DGX
      GO TO 1702
C 102   PRINT ORDINATE DESCRIPTION
C
 102  WRITE (ISOUT,8)
      GO TO (161,162,163,164,165,166,167,168,169,171,172,173,174,175,176
     1,177,178,179,170,170),NREQ
 161  WRITE (ISOUT,9)
      GO TO 170
 162  WRITE (ISOUT,10)
      GO TO 170
 163  WRITE (ISOUT,11)T1
      GO TO 170
 164  WRITE (ISOUT,12)T1
      GO TO 170
 165  WRITE (ISOUT,13)T1,T2
      GO TO 170
 166  WRITE (ISOUT,14)
      GO TO 170
 167  WRITE (ISOUT,15)T1,T2
      GO TO 170
 168  WRITE (ISOUT,13)T1,T2
      WRITE(ISOUT,17)
      GO TO 170
 169  WRITE (ISOUT,12)T1
      WRITE (ISOUT,17)
      GO TO 170
 171  WRITE (ISOUT,18)T1,MASCHN
      WRITE(ISOUT,17)
      GO TO 170
 172  WRITE (ISOUT,23)
      GO TO 170
 173  WRITE (ISOUT,24)
      GO TO 170
 174  WRITE (ISOUT,25)
      GO TO 170
 175  WRITE (ISOUT,26)
      GO TO 170
 176  WRITE (ISOUT,27) T1,T2
      GO TO 170
 177  WRITE (ISOUT,28) T1,T2
      GO TO 170
C
C************************** CODE INSERTION POINTS *************************
 178  CONTINUE
 179  CONTINUE
C************************** CODE INSERTION POINTS *************************
C
 170  WRITE (ISOUT,20) XGZ,YGZ
      IF(JC(1).EQ.3)  GO TO 1702
C
C     PRINT A PAIR OF PASTE-ON Y SCALES HERE
      WRITE (ISOUT,21)
      YY=YMIN+DGY*FLOAT(NYMAP)
      DO 1701  J=1,NYMAP
      WRITE (ISOUT,22)YY,YY
 1701 YY=YY-DGY
 1702 IF(LEFT-NX) 1021,1022,1022
 1021 NX=LEFT
```

```
 1022 MM=NX/(INC)
      M=MM+1
C     LEFT IS USED HERE AS THE NUMBER ØF PRINT CØLUMNS IN THE LAST
C     PRINTER STRIP
      LEFT=NX-MM*(INC)
C
C     STRIPS
      DØ 110 ISTRIP=1,M
      MAPRUN=MAPRUN+1
      IF (JC(1).EQ.3)  GØ TØ 1023
      XC2=XCØØRD+TINC
      XC3=XC2+TINC
      WRITE (ISØUT,1)MAPRUN
      WRITE (ISØUT,16)XCØØRD,XC2,XC3
 1023 KL=KKL+(NYMAP-1)*NXMAP
      IF(ISTRIP-M)103,104,103
  104 KINC=LEFT-1
      VLEFT=LEFT
      XCIN=VLEFT*DGX
      GØ TØ 1031
  103 KINC=INC-1
      XCIN=XCINC
 1031 CØNTINUE
      KLINK = KINC+1
      IF(JC(1).EQ.3) WRITE(MBTAPE)NYMAP,KLINK
C
C     RØWS
      DØ 200 J=1,NYMAP
      KH=KL+KINC
      KDC=0
      DØ 201 K=KL,KH
  201 FSUM=FSUM+ØMAP(K)
C
C     NUMBERS WITHIN RØWS
      DØ 300 K=KL,KH
      KDC=KDC+1
C     TRANSFER TØ CØDE FØR SELECTED PRESENTATIØN
      GØ TØ N2,(150,151,301)
C
C 150 CØDE FØR PØWER ØF TEN DISPLAY
  150 IF(ØMAP(K))105,106,107
  105 ASSIGN 121 TØ N3
      ØMAP(K)=-ØMAP(K)
      GØ TØ 109
  107 ASSIGN 300 TØ N3
  109 H = ALØG10(ØMAP(K))
      H1=AMØD(H,1.0)
      JMAP(KDC)=H-H1
      IF(JMAP(KDC).EQ.0)JMAP(KDC)=0
      ØMAP(K)=10.0**H1
      IF(ØMAP(K)-9.999)115,115,1091
 1091 ØMAP(K)=ØMAP(K)/10.0
      JMAP(KDC)=JMAP(KDC)+1
      GØ TØ 115
  106 JMAP(KDC)=0
      GØ TØ 300
  115 GØ TØ N3,(300,121)
C 121  RESET SIGN ØF MAP CØØRDINATE
  121 ØMAP(K)=-ØMAP(K)
      GØ TØ 300
```

```
C
C 151 CØDE FØR TWØ-LINE F11.3 DISPLAY
 151  JMAP(KDC)=ØMAP(K)/10.0
      ZMAP=JMAP(KDC)
      ØMAP(K)=ØMAP(K)-(ZMAP*10.0)
 300  CØNTINUE
      WRITE (ISØUT,2)(JMAP(K),K=1,
      WRITE (ISØUT,4)(ØMAP(K),K=KL,KH)
      GØ TØ 200
 301  WRITE (MBTAPE) (ØMAP(K),K=KL,KH)
 200  KL=KL-NXMAP
      IF (JC(1).EQ.3)  GØ TØ 110
      WRITE (ISØUT,16)XCØØRD,XC2,XC3
      XCØØRD=XCØØRD+XCIN
 110  KKL=KKL+INC
      RETURN
      END
```

```
$IBFTC PRC     LIST,DECK,M94/2
      SUBRØUTINE PRØC
C     26 FEB 67
C     P. FLUSSER  TECHNICAL ØPERATIØNS RESEARCH  SR  PRØC
C***THIS SUBRØUTINE CØMPUTES A NUMBER, KTR(I), WHICH DETERMINES
C***INTØ WHICH ZØNE ØR BUFFER  ZØNE THE I TH PARTICLE HAS LANDED.
C*** IT SETS KTR(I)=0 IF THE I TH PARTICLE LANDED IN THE FIRST ZØNE,
C*** AND CALLS SUBRØUTINE CALC TØ COMPUTE THE CØNTRIBUTIØN TØ THE
C*** FINAL RESULT ØF THIS PARTICLE.  IT ALSØ CØMPUTES A NEW VALUE FØR
C*** FØR NE, THE NUMBER ØF EMPTY SPACES IN THE PARTICLE ARRAY.
C*** FINALLY, THE NUMBER ØF PARTICLES THAT HAVE FALLEN IN EACH ZØNE
C*** IS CØMPUTED  (NP(I)).
C
C **********************************************************************
C
      CØMMØN /SET1/
     1          DIAM    ,DETID(12),IRISE   , IEXEC   , ISIN    , ISØUT    ,
     2          SD      , SPAR    , SSAM    , TME     , TMP1    , TMP2     ,
     3          T2M     , U       , VPR     , W       , HBURST  , SCLDHB   ,
     4          TID(40) , RMIN    , IDISTR  , SPAR1   , MBTAPE  , FSUM     ,
     5          SPAR4   , SPAR5   , SPAR6   , SPAR7   , SPAR8   , SPAR9
      CØMMØN  /SET3/
     1     BZ               ,BZ2              ,BZZ              ,BZ22
     2    ,DELTAX           ,DGX              ,DGY              ,DIFCØN
     3    ,DIFADJ           ,FMAS(500)        ,FMASS(200)       ,IC(18)
     4    ,ICØN             ,ICTR             ,IH               ,IØT(18)
     5    ,IP               ,IPØUT            ,ITT(18)          ,IV
     6    ,JC(18)           ,JIN              ,JØUT             ,JPØUT
     7    ,KTR(500)         ,KTAPE            ,LAST             ,MAPRUN
     8    ,MARRAY           ,MIN              ,MXREQ
     9    ,N                ,NA               ,NBZX             ,NBZX2
     1    ,NBZY             ,NCL              ,NE               ,NF
     2    ,NIJ              ,NMAP             ,NMAX             ,NØX
     3    ,NP(21)           ,NREQ             ,NS               ,NTAPES
     4    ,NTAPET           ,NTASK            ,NXMAP            ,NYMAP
     5    ,YMIN             ,PS(500)          ,PSIZE(200)       ,PACT(200)
     6    ,RØPART           ,SV(200)          ,T(500)           ,T1
     7    ,T2               ,TLIMIT           ,X(500)           ,XF
     8    ,XØ               ,XMAX             ,XMIN             ,XNMAP
     9    ,X1               ,X2               ,X3               ,X4
     1    ,Y(500)           ,YF               ,YØ               ,YMAX
      CØMMØN /SET4/  ØMAP(4000)
C
C **********************************************************************
C
      DATA PRØGRM/6H PRØC /
C
C **********************************************************************

C     NGØNE IS THE NUMBER ØF PARTICLES DISCARDED
      IF(ICTR) 1,1,2
C     INTØ ØR NEAR ENØUGH TØ THE AREA ØF INTEREST
    1 JCTR = 0
      DØ 107 I=1,NIJ
      IF(X(I)-XØ) 107,108,108
  108 IF(XF-X(I)) 107,109,109
  109 IF(Y(I)-YØ) 107,110,110
  110 IF(YF-Y(I)) 107,111,111
  111 JCTR=JCTR+1
      X(JCTR)=X(I)
```

```
      Y(JCTR)=Y(I)
      T(JCTR)=T(I)
      PS(JCTR)=PS(I)
      FMAS(JCTR)=FMAS(I)
  107 CONTINUE
C     NGONE IS THE NUMBER OF PARTICLES DISCARDED
      NGONE=NIJ-JCTR
      IF(NGONE) 20,2,52
 20   IRROR=-20
      GO TO 7734
   52 JPTR=JCTR+1
      BIG=X0-1.0
      DO 104 I=JPTR,NIJ
      KTR(I)=0
  104 X(I)=BIG
      NE=NE+NGONE
      NIJ=JCTR
      IF(JCTR)21,15,2
 21   IRROR=-21
 7734 CALL ERROR(PROGRM,IRROR,ISOUT)
C ***** END OF PARTICLE (CLOUD SUBDIVISION) DISCARDING CODE *********
    2 DO 9 I=1,NIJ
      R=X(I)-X1
      K=JIN+2
      DO 8 J=2,K,2
      R=R-BZ2
      IF(R) 3,3,6
    3 IF(J-2) 4,4,5
    4 KTR(I)=0
   10 NE=NE+1
   11 IP=I
      CALL CALC
      GO TO 9
    5 KTR(I)=J-3
      NP(J-3)=NP(J-3)+1
      IF(J-4)22,25,9
 22   IRROR=-22
      GO TO 7734
    6 R=R-DELTAX
      IF(R) 7,7,8
    7 KTR(I)=J-2
      IF(J-2) 10,10,12
   12 NP(J-2)=NP(J-2)+1
      GO TO 9
   25 KTR(I)=2
      GO TO 11
    8 CONTINUE
      KTR(I)=JIN
      NP(JIN)=NP(JIN)+1
    9 CONTINUE
   15 RETURN
      END
```

```
$IBFTC RNN1     LIST,DECK,M94/2
      SUBRØUTINE RUN1
C     26  FEB  67
C     P. FLUSSER  TECHNICAL ØPERATIØNS RESEARCH  SR  RUN1
C
C***THIS SUBRØUTINE IS CALLED IF AND ØNLY IF ALL THE PARTICLES THAT
C***ARE ØN THE TAPE WHICH WILL BE READ NEXT EITHER FALL INTØ
C*** THE AREA CURRENTLY BEING CØNSIDERED ØR CAN BE DISCARDED
C*** ALTØGETHER.  THIS SUBRØUTINE CALLS CALC WHICH THEN CØMPUTES
C*** THE CURRENT REQUEST.
C
C *********************************************************************
C
      CØMMØN /SET1/
     1          DIAM     ,DETID(12),IRISE    , IEXEC    , ISIN     , ISØUT     ,
     2          SD       , SPAR    , SSAM    , TME      , TMP1     , TMP2      ,
     3          T2M      , U       , VPR     , W        , HBURST   , SCLDHB    ,
     4          TID(40), RMIN    , IDISTR  , SPAR1    , MBTAPE   , FSUM      ,
     5          SPAR4    , SPAR5   , SPAR6   , SPAR7    , SPAR8    , SPAR9
      CØMMØN  /SET3/
     1   BZ              ,BZZ             ,BZZ              ,BZ22
     2   ,DELTAX         ,DGX             ,DGY              ,DIFCØN
     3   ,DIFADJ         ,FMAS(500)       ,FMASS(200)       ,IC(18)
     4   ,ICØN           ,ICTR            ,IH               ,IØT(18)
     5   ,IP             ,IPØUT           ,ITT(18)          ,IV
     6   ,JC(18)         ,JIN             ,JØUT             ,JPØUT
     7   ,KTR(500)       ,KTAPE           ,LAST             ,MAPRUN
     8   ,MARRAY         ,MIN             ,MXREQ
     9   ,N              ,NA              ,NBZX             ,NBZX2
     1   ,NBZY           ,NCL             ,NE               ,NF
     2   ,NIJ            ,NMAP            ,NMAX             ,NØX
     3   ,NP(21)         ,NREQ            ,NS               ,NTAPES
     4   ,NTAPET         ,NTASK           ,NXMAP            ,NYMAP
     5   ,YMIN           ,PS(500)         ,PSIZE(200)       ,PACT(200)
     6   ,RØPART         ,SV(200)         ,T(500)           ,T1
     7   ,T2             ,TLIMIT          ,X(500)           ,XF
     8   ,XØ             ,XMAX            ,XMIN             ,XNMAP
     9   ,X1             ,X2              ,X3               ,X4
     1   ,Y(500)         ,YF              ,YØ               ,YMAX
      CØMMØN /SET4/  ØMAP(4000)
C
C *********************************************************************
C
      DATA PRØGRM/6H RUN1 /
C
C *********************************************************************
C *********************************************************************
C
C*** ARE THERE ANY CURRENT PARTICLES LEFT IN CØRE...
C*** HAVE THØSE PARTICLES WHICH FALL ØUTSIDE THE AREA ØF INTEREST
C***BEEN DISCARDED...
 10   IF(ICTR)2,3,4
 2    IRRØR=-2
 7734 CALL ERRØR(PRØGRM,IRRØR,ISØUT)
 3    ASSIGN 200 TØ N
      GØ TØ 5
C***ARE THERE ANY CURRENT PARTICLES LEFT IN CØRE...
 4    IF(NIJ)41,42,42
 41   ASSIGN 200 TØ N
      NIJ=MARRAY
```

```
      GØ TØ 43
 42   ASSIGN 100 TØ N
 5    READ (IPØUT)NIJ
      IF(NIJ) 6,7,8
C***ARE WE DONE...
 6    IERRØR=-6
      GØ TØ 7734
 8    READ (IPØUT)(X(I),Y(I),T(I),PS(I),FMAS(I),I=1,NIJ)
 43   DØ 300 I=1,NIJ
C***PRELIMINARY CHECK ØF PARTICLES
      GØ TØ N,(100,200)
 200  IF(X(I)-X1)300,201,201
 201  IF(X(I)-X4)202,202,300
 202  IF(Y(I)-YØ)300,203,203
 203  IF(Y(I)-YF)100,100,300
 100  IP=I
      CALL CALC
 300  CØNTINUE
      GØ TØ 10
 7    RETURN
      END
```

```
$IBFTC SHIF     LIST,DECK,M94/2
      SUBRØUTINE SHIFT
C     26  FEB  67
C     P. FLUSSER  TECHNICAL ØPERATIØNS RESEARCH  SR  SHIFT
C     THIS SUBRØUTINE WRITES ØN THE APPRØPRIATE TAPE THE PARTICLE
C     PARAMETERS ØF THØSE PARTICLES WHICH FALL IN THE MØST DENSELY
C     PØPULATED ZØNE ØF THE AREA ØF INTEREST.  IT ALSØ CØMPUTES A NEW
C     VALUE ØF NE, THE NUMBER ØF EMPTY SPACES IN THE PARTICLE ARRAY.
C
C *****************************************************************
C
C     NS     = NUMBER ØF PARTICLES TØ BE WRITTEN ØUT
C     NE     = NUMBER ØF EMPTY SPEACES CURRENTLY AVAILABLE
C     KTR(I) = INDEX INDICATING INTØ WHICH ZØNE THE I TH PARTICLE HAS
C              LANDED
C     JØUT   = INDEX ØF ZØNE TØ BE WRITTEN ØUT
C     X,Y,T,ID,PSI,  =  PARTICLE PARAMETERS
C     IØT(JØUT/2) = TAPE NUMBER ØF TAPE TØ BE USED IN CURRENT WRITE
C     KTAPE       = TAPE NUMBER ØF TAPE TØ BE USED IN CURRENT WRITE
C     JIN    = LARGEST INDEX APPEARING IN PARTICLE CLASSIFICATIØN
C     NMAX   = MAXIMIM NUMBER ØF UNSØRTED PARTICLES TØ BE WRITTEN  ØUT
C                 IN ØNE DATA BLØCK
C     JT     = TØP CØUNTER
C     JB     = BØTTØM CØUNTER
C
C *****************************************************************
C
C     IF NTH,NBH ØR NTPH ARE ZERØ, THERE IS A HØLE IN THE TØP, BØTTØM ØR
C     TEMPØRARY STØRAGE RESPECTIVELY.  IF THESE VARIABLES ARE 1,
C     THERE IS NØ HØLE THERE
C     NHCTR = INDEX KEEPING TRACK ØF SPACE AVAILABLE FØR INSERTIØN ØF
C                CØNTENTS ØF TEMPØRARY STØRAGE AT THE END ØF EXECUTIØN.
C     NP(I)  = NUMBER ØF PARTICLES WITH CLASSIFICATIØN NUMBER I
C     IF LAST=0, THE LAST ZØNE HAS BEEN SØRTED.  IF LAST=1 THIS STILL
C     NEEDS TØ BE DØNE.
C     MARRAY = DIMENSIØN ØF PARTICLE ARRAY
C
C *****************************************************************
C
      CØMMØN /SET1/
     1         DIAM    ,DETID(12),IRISE  , IEXEC   , ISIN    , ISØUT    ,
     2         SD      , SPAR    , SSAM   , TME     , TMP1    , TMP2     ,
     3         T2M     , U       , VPR    , W       , HBURST  , SCLDHB   ,
     4         TID(40), RMIN    , IDISTR , SPAR1   , MBTAPE  , FSUM     ,
     5         SPAR4   , SPAR5   , SPAR6  , SPAR7   , SPAR8   , SPAR9
      CØMMØN  /SET3/
     1    BZ              ,BZ2            ,BZZ             ,BZ22
     2   ,DELTAX          ,DGX            ,DGY             ,DIFCØN
     3   ,DIFADJ          ,FMAS(500)      ,FMASS(200)      ,IC(18)
     4   ,ICØN            ,ICTR           ,IH              ,IØT(18)
     5   ,IP              ,IPØUT          ,ITT(18)         ,IV
     6   ,JC(18)          ,JIN            ,JØUT            ,JPØUT
     7   ,KTR(500)        ,KTAPE          ,LAST            ,MAPRUN
     8   ,MARRAY          ,MIN            ,MXREQ
     9   ,N               ,NA             ,NBZX            ,NBZX2
     1   ,NBZY            ,NCL            ,NE              ,NF
     2   ,NIJ             ,NMAP           ,NMAX            ,NØX
     3   ,NP(21)          ,NREQ           ,NS              ,NTAPES
     4   ,NTAPET          ,NTASK          ,NXMAP           ,NYMAP
     5   ,YMIN            ,PS(500)        ,PSIZE(200)      ,PACT(200)
```

```
     6    ,RØPART        ,SV(200)        ,T(500)         ,T1
     7    ,T2            ,TLIMIT         ,X(500)         ,XF
     8    ,XØ            ,XMAX           ,XMIN           ,XNMAP
     9    ,X1            ,X2             ,X3             ,X4
     1    ,Y(500)        ,YF             ,YØ             ,YMAX
      CØMMØN /SET4/  ØMAP(4000)
C
C ********************************************************************
C
      DATA PRØGRM/6H SHIFT/
C
C ********************************************************************
C ********************************************************************
C
C     ARE WE SØRTING THE LAST ZØNE ... 3=NØ, 6=YES
      IF(LAST) 3,3,60
C  60 ARE WE DUMPING LAST ZØNE ... 5=YES, 3=NØ
   60 IF(JØUT-JIN) 3,3,6
    6 IRRØR=-6
      GØ TØ 7734
C     SET UP CØUNTERS
    3 JT = 1
      JB = MARRAY
      NTH=1
      NBH=1
      NTPH=0
      NHCTR=0
C     IS THERE A HØLE IN THE TØP ))) IF YES, EXAMINE BØTTØM)
   10 IF(KTR(JT)) 9,12,11
    9 IRRØR=-9
 7734 CALL ERRØR(PRØGRM,IRRØR,ISØUT)
   12 NTH=0
      GØ TØ 15
C     IS JT TH PARTICLE TØ BE DUMPED ... IF YES, EXAMINE NEXT TØ
C     PARTICLE, IF NØT, EXAMINE BØTTØM PARTICLE)
   11 IF(KTR(JT)-JØUT) 14,13,14
C*** THIS PARTICLE DØES NØT FALL IN BUFFER ZØNE.  ZERØ ØUT
C***IDENTIFICATIØN NUMBER.
   13 KTR(JT)=0
      GØ TØ 777
   14 IF(KTR(JT)-1-JØUT) 15,16,15
C*** THIS PARTICLE FALLS IN BUFFER ZØNE.  IT NEEDS TØ BE BØTH
C*** WRITTEN ØUT AND RETAINED.  INCREASE IDENTIFICATIØN NUMBER
C*** BY ØNE.
   16 KTR(JT)=KTR(JT)+1
  777 JT=JT+1
      IF(JT-NS) 10,10,40
C     IS THERE A HØLE IN THE BØTTØM... IF YES, SEE IF THERE IS
C     PARTICLE THAT WANTS TØ CØME DØWN FRØM THE TØP.  IF NØT, EXAMINE
C     PARTICLE.
   15 IF(NBH) 17,18,17
C     DOES PARTICLE WANT TØ BE DUMPED... IF YES, MØVE IT TØ THE TØP, I
C     NØT, EXAMINE NEXT BØTTØM PARTICLE
   17 IF(KTR(JB)) 20,19,20
   19 NBH=0
   18 IF(NTH) 78,888,78
C     MØVE TØP TØ BØTTØM
   78 X(JB)=X(JT)
      Y(JB)=Y(JT)
      T(JB)=T(JT)
```

```
      PS(JB)=PS(JT)
      FMAS(JB)=FMAS(JT)
      KTR(JB)=KTR(JT)
      NTH=0
      NBH=1
C     ARE WE FINISHED .. IF NØT, CØNTINUE,  IF YES, DUMP PARTICLES
C     CØMPUTE A NEW VALUE FØR NE
C*** ARE WE DØNE...
  888 JB=JB-1
      IF(JB-NS) 40,17,17
   20 IF(KTR(JB)-JØUT) 24,23,24
C*** THIS PARTICLE DØES NØT FALL IN BUFFER ZØNE.
C*** XERØ ØUT IDENTIFICATIØN NUMBER.
   23 KTR(JB)=0
      GØ TØ 26
   24 IF(KTR(JB)-1-JØUT) 888,25,888
C*** THIS PARTICLE FALLS IN BUFFER ZØNE.. IT NEEDS TØ BE BØTH
C*** WRITTEN ØUT AND RETAINED.  INCREASE ID. NØ. BY ØNE.
   25 KTR(JB)=KTR(JB)+1
   26 IF(NTH) 27,87,27
   27 IF(NTPH) 30,77,30
 30   IRRØR=-30
      GØ TØ 7734
C     MØVE TØP TØ TEMPØRARY STØRAGE
   77 XEMP=X(JT)
      YEMP=Y(JT)
      TEMP=T(JT)
      PEMP=PS(JT)
      FEMP=FMAS (JT)
      KEMP=KTR(JT)
      NTPH=1
C     MØVE BØTTØM TØ TØP
   87 X(JT)=X(JB)
      Y(JT)=Y(JB)
      T(JT)=T(JB)
      PS(JT)=PS(JB)
      FMAS(JT)=FMAS(JB)
      KTR(JT)=KTR(JB)
C*** TØ AVØID DUPLICATIØN ØF PARTICLES, ZERØ ØUT IDENTIFICATIØN
C*** NUMBER.
      KTR(JB)=0
      NBH=0
      NTH=1
C*** KEEP TRACK ØF EMPTY SPACE IN BØTTØM
      NHCTR=JB
      GØ TØ 777
   40 IF(NTPH) 67,5000,67
C*** MØVE TEMPØRARY STØRAGE TØ BØTTØM.
   67 X(NHCTR)=XEMP
      Y(NHCTR)=YEMP
      T(NHCTR)=TEMP
      PS(NHCTR)=PEMP
      FMAS(NHCTR)=FEMP
      KTR(NHCTR)=KEMP
 5000 WRITE (KTAPE)NS
      WRITE (KTAPE)(X(I),Y(I),T(I),PS(I),FMAS(I),I=1,NS)
C*** ADJUST THE NUMBER ØF EMPTIES AND THE PARTICLE CØUNT
      IF(JØUT-2) 100,102,101
  100 IRRØR=-100
      GØ TØ 7734
```

```
  102 NE=NE+NP(1)+NP(2)
      NP(1)=0
      GO TO 110
  101 IF(JOUT-JIN) 103,103,105
 105  IERROR=-105
      GO TO 7734
  103 NE=NE+NP(JOUT)
  110 NP(JOUT+2)=NP(JOUT+2)+NP(JOUT+1)
      NP(JOUT+1)=0
      NP(JOUT)=0
  120 RETURN
      END
```

```
$IBFTC SLID     LIST,DECK,M94/2
      SUBRØUTINE SLIDE
C     P. FLUSSER   TECHNICAL ØPERATIØNS RESEARCH   SR  SLIDE
C     26 FEB 67
C
C***SUBRØUTINE SLIDE MØVES THE CØNTENTS ØF THE RIGHT BUFFER ZØNE
C***INTØ THE LEFT BUFFER ZØNE AND ZERØS ØUT THE REMAINING
C***ENTRIES IN THE MAP ARRAY.
C***NØX   = NUMBER ØF ØUTPUT GRID PØINTS IN THE ZØNE ITSELF
C***  CØUNTING IN THE X DIRECTIØN.
C*** NBZX2=  NUMBER ØF ØUTPUT GRID PØINTS IN THE BUFFER ZØNE
C***        CØUNTING IN THE X DIRECTIØN.
C*** NX=   NUMBER ØF ØUTPUT GRID PØINTS IN THE ZØNE ITSELF PLUS
C*** ØNE BUFFER ZØNE CØUNTING IN THE X DIRECTIØN.
C*** NXMAP= NUMBER ØF ØUTPUT GRID PØINTS IN THE ENTIRE MAP ,CØUNTING
C***TWØ BUFFER ZØNES) IN THE X DIRECTIØN.
C*** NYMAP= NUMBER ØF ØUTPUT GRID PØINTS IN ENTIRE MAP CØUNTING
C*** IN Y DIRECTIØN.
C*** ØMAP= MAP STØRAGE
C
C ***************************************************************
C
      CØMMØN /SET1/
     1         DIAM    ,DETID(12),IRISE   , IEXEC   , ISIN    , ISØUT    ,
     2         SD      , SPAR    , SSAM    , TME     , TMP1    , TMP2     ,
     3         T2M     , U       , VPR     , W       , HBURST  , SCLDHB   ,
     4         TID(40) , RMIN    , IDISTR  , SPAR1   , MBTAPE  , FSUM     ,
     5         SPAR4   , SPAR5   , SPAR6   , SPAR7   , SPAR8   , SPAR9
      CØMMØN  /SET3/
     1    BZ             ,BZ2            ,BZZ            ,BZ22
     2    ,DELTAX        ,DGX            ,DGY            ,DIFCØN
     3    ,DIFADJ        ,FMAS(500)      ,FMASS(200)     ,IC(18)
     4    ,ICØN          ,ICTR           ,IH             ,IØT(18)
     5    ,IP            ,IPØUT          ,ITT(18)        ,IV
     6    ,JC(18)        ,JIN            ,JØUT           ,JPØUT
     7    ,KTR(500)      ,KTAPE          ,LAST           ,MAPRUN
     8    ,MARRAY        ,MIN            ,MXREQ
     9    ,N             ,NA             ,NBZX           ,NBZX2
     1    ,NBZY          ,NCL            ,NE             ,NF
     2    ,NIJ           ,NMAP           ,NMAX           ,NØX
     3    ,NP(21)        ,NREC           ,NS             ,NTAPES
     4    ,NTAPET        ,NTASK          ,NXMAP          ,NYMAP
     5    ,YMIN          ,PS(500)        ,PSIZE(200)     ,PACT(200)
     6    ,REPART        ,SV(200)        ,T(500)         ,T1
     7    ,T2            ,TLIMIT         ,X(500)         ,XF
     8    ,XØ            ,XMAX           ,XMIN           ,XNMAP
     9    ,X1            ,X2             ,X3             ,X4
     1    ,Y(500)        ,YF             ,YØ             ,YMAX
      CØMMØN /SET4/  ØMAP(4000)
C
C ***************************************************************
C ***************************************************************
C
      M=NBZX2+NØX
      NX=M
      N=0
      DØ 503 J=1,NYMAP
      DØ 501 K=1 ,NBZX2
      NM=N+K
      MM=M+K
```

```
C*** SHIFT BUFFER ZØNE
 501  ØMAP(NN)=ØMAP(MM)
      L=N+NBZX2+1
      LMN=L+NX-1
      DØ 502 I=L,LMN
C***  ZERØ ØUT WHATEVER IS LEFT
  502 ØMAP(I)=0.0
      M=M+NXMAP
  503 N=N+NXMAP
      RETURN
      END
```

```
$IBFTC ZER     LIST,DECK,M94/2
      SUBRØUTINE ZERØ
C     26  FEB  67
C     P. FLUSSER   TECHNICAL ØPERATIØNS RESEARCH  SR  ZERØ
C*** THIS SUBRØUTINE MAKES RØØM FØR NIJ PARTICLES TØ BE WRITTEN IN
C*** THE PARTICLE ARRAY BY MØVING THE PARTICLE PARAMETERS INTØ THE BØDY
C***ØF THE ARRAY.
C*** JT= TØP CØUNTER
C*** JB= BØTTØM CØUNTER
C
C ************************************************************************
      CØMMØN /SET1/
     1         DIAM   ,DETID(12),IRISE  , IEXEC  , ISIN   , ISØUT    ,
     2         SD     , SPAR   , SSAM   , TME    , TMP1   , TMP2     ,
     3         T2M    , U      , VPR    , W      , HBURST , SCLDHB   ,
     4         TID(40), RMIN   , IDISTR , SPAR1  , MBTAPE , FSUM     ,
     5         SPAR4  , SPAR5  , SPAR6  , SPAR7  , SPAR8  , SPAR9
      CØMMØN  /SET3/
     1    BZ             ,BZ2            ,BZZ             ,BZ22
     2   ,DELTAX         ,DGX            ,DGY             ,DIFCØN
     3   ,DIFADJ         ,FMAS(500)      ,FMASS(200)      ,IC(18)
     4   ,ICØN           ,ICTR           ,IH              ,IØT(18)
     5   ,IP             ,IPØUT          ,ITT(18)         ,IV
     6   ,JC(18)         ,JIN            ,JØUT            ,JPØUT
     7   ,KTR(500)       ,KTAPE          ,LAST            ,MAPRUN
     8   ,MARRAY         ,MIN            ,MXREQ
     9   ,N              ,NA             ,NBZX            ,NBZX2
     1   ,NBZY           ,NCL            ,NE              ,NF
     2   ,NIJ            ,NMAP           ,NMAX            ,NØX
     3   ,NP(21)         ,NREQ           ,NS              ,NTAPES
     4   ,NTAPET         ,NTASK          ,NXMAP           ,NYMAP
     5   ,YMIN           ,PS(500)        ,PSIZE(200)      ,PACT(200)
     6   ,RØPART         ,SV(200)        ,T(500)          ,T1
     7   ,T2             ,TLIMIT         ,X(500)          ,XF
     8   ,XØ             ,XMAX           ,XMIN            ,XNMAP
     9   ,X1             ,X2             ,X3              ,X4
     1   ,Y(500)         ,YF             ,Y2              ,YMAX
      CØMMØN /SET4/  ØMAP(4000)
      DATA PRØGRM/6H ZERØ /
      JT=1
      JB=MARRAY
C*** IS THERE A HØLE IN THE TØP... IF YES, GØ ØN, IF NØT, CHECK BØTTØM.
 2    IF(KTR(J))3,4,5
 3    IRRØR=-3
 7734 CALL ERRØR(PRØGRM,IRRØR,ISØUT)
 4    JT=JT+1
C*** ARE WE DØNE...
      IF(JT-NIJ)2,2,10
C*** IS THERE HØLE IN THE BØTTØM... IF YES, MØVE A PARTICLE FRØM THE
C*** TØP, IF NØT, TRY AND FIND ØNE.
 5    IF(KTR(JB))6,7,8
 6    IRRØR=-6
      GØ TØ 7734
C*** MØVE PARTICLE PARAMETERS AND DECREMENT BØTTØM CØUNTER.
 7    X(JB)=X(JT)
      Y(JB)=Y(JT)
      T(JB)=T(JT)
      PS(JB)=PS(JT)
      FMAS(JB)=FMAS(JT)
      KTR(JB)=KTR(JT)
```

```
      JB=JB-1                                                    ZER   60
      GØ TØ 4                                                    ZER   61
    8 JB=JB-1                                                    ZER   62
C*** ARE THERE ENØUGH HØLES....                                  ZER   63
      IF(JB-NIJ)9,9,5                                            ZER   64
    9 IRRØR=-9                                                   ZER   65
      GØ TØ 7734                                                 ZER   66
   10 RETURN                                                     ZER   67
      END                                                        ZER   68
```

THE PRINTED OUTPUT OF THE PROGRAM

An example of the output is shown in the following pages. This consists of two parts: (1) a listing of the particles impacted tape (IPOUT) which is optional (see p. 49), and (2) a map. The map has been hand-contoured to show the limit of particle deposition (outside contour representing 0 R/h) and the 10 R/h line (inside contour). Large maps are divided into a number of vertical strips and the strips are numbered in increasing sequence for ease of identification and assembly into a complete map. This sequencing is accomplished automatically no matter how large the map is. The maximum strip width is fixed by the geometry of the printer, but the program automatically ascertains that the total number of grid points across all strips is that which the user specified. In the vertical direction on the paper (north-south) all required data points are simply printed in their correct positions and, therefore, no further identification is required. It should be noted, for the sake of correctly interpreting the output map, that the coordinates of the lowest, leftmost map data point are not the minimum coordinate pair put in by the user; they are the minimum coordinate pair incremented by one x and y grid interval. Thus, this lower left point is the first data point falling one full grid interval within the area of interest to the user.

* * * * * * * * * * *

THE DEPARTMENT OF DEFENSE FALLOUT PREDICTION SYSTEM

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OUTPUT PROCESSOR MODULE

PREPARED BY
TECHNICAL OPERATIONS RESEARCH, INC.
BURLINGTON, MASS.

LISTING OF GROUNDED PARTICLES

TRANSPORT IDENTIFICATION

FIFTH LARGE SCALE TEST OF THE DELFIC MODEL. 1 FEB. 1967. TRANSPOST

BLOCK 1

NO. OF PARTICLES IN THIS BLOCK IS 150

X	Y	T	PS	MASS
999813.7031	999866.8594	109.[illegible]602	661.0439	0.0090
999972.2656	999950.7734	153.9715	661.0439	0.0090
999970.7891	999951.6797	150.3999	661.0439	0.0090
1000027.4297	999938.4609	238.7078	661.0439	0.0090
999662.4688	999698.2500	217.6443	661.0439	0.0090
999663.4297	999698.6719	218.0461	661.0439	0.0090
999877.9453	999762.4375	270.3820	661.0439	0.0090
999956.3516	999877.6875	258.7040	661.0439	0.0090
999836.9375	999713.0938	304.3261	661.0439	0.0090
999806.2500	999705.2266	290.9941	661.0439	0.0090
1000158.4531	999878.6328	330.9649	661.0439	0.0090
1000141.9453	999877.0000	320.4454	661.0439	0.0090
1000103.4141	999840.0781	355.6223	661.0439	0.0090
10001[illegible]4.9844	999879.2813	335.1282	661.0439	0.0090
1000040.3828	999782.6016	365.5172	661.0439	0.0090
1000086.0625	999809.9453	400.1892	661.0439	0.0090
1000064.4609	999804.8984	387.9202	661.0439	0.0090
1000341.3359	999952.9609	417.7250	661.0439	0.0090
1000336.1484	999951.8359	414.3079	661.0439	0.0090
1000511.2344	1000045.2578	441.2204	661.0439	0.0090
1000513.3906	1000045.8125	442.6173	661.0439	0.0090
1000350.3750	999944.4766	467.4481	661.0439	0.0090
1000370.6328	999960.4609	460.4454	661.0439	0.0090
1000618.8516	1000088.9922	481.9517	661.0439	0.0090
[illegible]	1000206.9531	504.9391	661.0439	0.0090
1000823.4531	1000202.7734	501.5282	661.0439	0.0090

1000922.6719	1000252.3125	521.0816	661.0439	0.0090
1001043.8828	1000316.1406	541.8622	661.0439	0.0090
1001034.0156	1000311.8759	538.6753	661.0439	0.0090
1001116.6328	1000350.0391	558.5450	661.0439	0.0090
1001293.7109	1000514.4766	559.4243	661.0439	0.0022
1001293.7109	1000177.1875	559.4243	661.0439	0.0022
1000956.4141	1000177.1875	559.4243	661.0439	0.0022
1000956.4141	1000514.4766	559.4243	661.0439	0.0022
999779.9453	999855.3594	108.1759	540.6692	0.0090
999662.8516	999700.3594	215.4246	540.6692	0.0090
999940.2422	999855.7188	300.7138	540.6692	0.0090
999942.0234	999860.6953	292.7125	540.6692	0.0090
999942.3906	999861.7266	291.0587	540.6692	0.0090
999835.2656	999764.7969	303.9042	540.6692	0.0090
1000310.9297	999921.4219	396.4778	540.6692	0.0090
1000287.4766	999921.4141	379.9917	540.6692	0.0090
1000281.7109	999921.9766	375.6066	540.6692	0.0090
999970.1563	999686.3359	436.9803	540.6692	0.0090
1000015.8828	999719.2344	428.3916	540.6692	0.0090
1000466.8594	999978.7656	481.6200	540.6692	0.0090
1000286.0391	999888.2109	455.6174	540.6692	0.0090
1000518.9219	1000003.6953	499.9505	540.6692	0.0090
1000493.5938	999994.2266	490.0412	540.6692	0.0090
1000362.9453	999905.4375	526.5606	540.6692	0.0090
1000376.5938	999914.9297	522.9203	540.6692	0.0090
1000880.8281	1000192.4063	555.3261	540.6692	0.0090
1000883.1719	1000190.8828	554.7974	540.6692	0.0090
1000631.6953	1000043.5469	548.0274	540.6692	0.0090
1001035.7188	1000251.0547	580.5498	540.6692	0.0090
1001186.9922	1000330.3047	615.6166	540.6692	0.0090
1001174.6406	1000325.7813	611.5813	540.6692	0.0090
1001587.5938	1000627.9844	643.7514	540.6692	0.0090
1001583.6016	1000625.4375	643.1794	540.6692	0.0090
1001816.2266	1000778.6563	675.0872	540.6692	0.0090
1001998.7031	1000954.3125	675.0941	540.6692	0.0022
1001998.7031	1000617.0156	676.0941	540.6692	0.0022
1001661.4063	1000617.0156	676.0941	540.6692	0.0022
1001661.4063	1000954.3125	676.0941	540.6692	0.0022
1002215.5547	1001094.7109	707.4751	540.6692	0.0022
1002215.5547	1000757.4141	707.4751	540.6692	0.0022
1001878.2656	1000757.4141	707.4751	540.6692	0.0022
1001878.2656	1001094.7109	707.4751	540.6692	0.0022
1002200.6953	1001074.4219	702.1252	540.6692	0.0022
1002200.6953	1000737.1250	702.1252	540.6692	0.0022
1001863.3984	1000737.1250	702.1252	540.6692	0.0022
1001863.3984	1001074.4219	702.1252	540.6692	0.0022
1002505.4766	1001082.7578	733.0195	540.6692	0.0022
1002505.4766	1000745.4609	733.0195	540.6692	0.0022
1002036.2031	1000847.0000	731.0921	540.6692	0.0022
1002036.2031	1001184.2969	731.0921	540.6692	0.0022
1002408.0781	1001090.6641	722.2159	540.6692	0.0022
1002408.0781	1000753.3672	722.2159	540.6692	0.0022
1001982.2656	1000816.6563	720.8784	540.6692	0.0022
1001982.2656	1001153.9531	720.8784	540.6692	0.0022
1002876.6484	1001161.4609	749.9310	540.6692	0.0022
1002876.6484	1000824.1641	749.9310	540.6692	0.0022
1002440.8984	1000950.7969	751.4804	540.6692	0.0022
1002440.8984	1001288.0938	751.4804	540.6692	0.0022
999890.5156	999902.7109	196.0146	455.9091	0.0090

999681.0859	999708.1719	230.6680	455.9091	0.0090
999935.2891	999831.8516	286.7701	455.9091	0.0090
999932.1406	999842.4161	335.8081	455.9091	0.0090
999719.0313	999599.5781	383.2466	455.9091	0.0090
1000218.9531	999755.1172	510.1834	455.9091	0.0090
1000217.0000	999761.1094	503.5328	455.9091	0.0090
1000216.7422	999761.9063	502.6511	455.9091	0.0090
1000218.5078	999756.4844	508.6675	455.9091	0.0090
1000436.6328	999919.3047	565.0691	455.9091	0.0090
1000513.9531	999961.4063	544.4145	455.9091	0.0090
1000672.2578	1000006.0469	606.9872	455.9091	0.0090
1000541.6172	999931.5469	597.7697	455.9091	0.0090
999998.9063	1000001.7734	3.5909	12473.7008	0.0090
999998.6875	1000001.9922	3.944	12473.7008	0.0090
999998.6953	1000001.9844	3.9341	12473.7008	0.0090
999998.6484	1000002.0469	4.1363	12473.7008	0.0090
999998.3594	1000002.3516	4.7463	12473.7008	0.0090
999998.1641	1000002.5703	5.2631	12473.7008	0.0090
999990.0156	1000024.9922	53.2560	661.0439	0.0090
1000379.0938	1000004.4219	395.6474	850.1669	0.0090
1000510.0625	1000086.4375	379.1820	850.1669	0.0090
1000373.4609	1000010.7031	363.5162	850.1669	0.0090
1000488.1719	1000076.0469	369.2923	850.1669	0.0090
1000351.4375	1000003.2734	352.2446	850.1669	0.0090
1000355.7344	1000004.7266	354.4451	850.1669	0.0090
1000119.0391	999873.4531	335.7248	850.1669	0.0090
1000097.4609	999865.6875	318.4868	850.1669	0.0090
1000080.7734	999856.7344	323.2555	850.1669	0.0090
1000085.4844	999863.3672	304.1440	850.1669	0.0090
1000102.7578	999890.5781	286.5992	850.1669	0.0090
1000101.1016	999877.9297	295.9191	850.1669	0.0090
999932.3828	999785.7656	275.2522	850.1669	0.0090
999875.5547	999765.7109	256.5722	850.1669	0.0090
999896.9844	999789.9844	239.9431	850.1669	0.0090
999867.7578	999763.5469	253.3261	850.1669	0.0090
999916.6250	999805.0859	233.3254	850.1669	0.0090
999904.5000	999791.4219	243.5866	850.1669	0.0090
999979.8047	999875.2422	220.1690	850.1669	0.0090
1000025.3984	999947.6094	199.6659	850.1669	0.0090
999994.2656	999924.6172	208.2278	850.1669	0.0090
1000044.4453	999967.6719	184.0057	850.1669	0.0090
1000025.2109	999948.9531	196.4965	850.1669	0.0090
999792.9219	999790.8984	166.1074	850.1669	0.0090
999772.4453	999774.8750	179.2275	850.1669	0.0090
999925.6094	999920.3984	140.4025	850.1669	0.0090
999899.8359	999885.5625	158.2701	850.1669	0.0090
1000013.5703	999995.6094	110.8231	850.1669	0.0090
999973.7578	999956.3516	126.5207	850.1669	0.0090
1000006.9766	999980.9219	117.1562	850.1669	0.0090
999994.1484	1000020.0234	50.5690	850.1669	0.0090
999981.1250	1000025.0703	26.4409	850.1669	0.0090
1000102.8203	999930.7500	229.3430	1219.1012	0.0090
999953.0234	999835.1875	219.4342	1219.1012	0.0090
999974.7344	999852.7344	209.8566	1219.1012	0.0090
999948.1875	999843.1016	201.0213	1219.1012	0.0090
999967.6172	999850.2969	207.1759	1219.1012	0.0090
999964.4453	999854.3984	196.6471	1219.1012	0.0090
999942.1328	999848.2031	186.7100	1219.1012	0.0090
999995.4375	999904.6328	177.6155	1219.1012	0.0090

BLOCK 2

NO. OF PARTICLES IN THIS BLOCK IS 144

X	Y	T	PS	MASS
1000544.4844	999931.8594	603.1177	455.9091	0.0090
1001193.3281	1000307.7031	653.7841	455.9091	0.0090
1001217.7422	1000318.8281	660.8842	455.9091	0.0090
1001454.0938	1000445.9844	709.7954	455.9091	0.0090
1001388.8594	1000401.9141	699.7327	455.9091	0.0090
1001401.7031	1000408.2031	700.7300	455.9091	0.0090
1002030.1797	1000862.6484	742.8521	455.9091	0.0090
1002055.3828	1000875.4219	746.3553	455.9091	0.0090
1002563.2969	1000975.6406	788.0953	455.9091	0.0090
1002850.9609	1001049.3047	792.0753	455.9091	0.0022
1002850.9609	1000712.0078	792.0753	455.9091	0.0022
1002308.2031	1000932.3047	793.1015	455.9091	0.0022
1002308.2031	1001269.6016	793.1015	455.9091	0.0022
1003109.2031	1001158.5859	831.9199	455.9091	0.0022
1003109.2031	1000821.2891	831.9199	455.9091	0.0022
1002732.5234	1000[illegible]13.1250	833.4435	455.9091	0.0022
1002732.5234	1001250.4219	833.4435	455.9091	0.0022
1003090.6719	1001138.2344	826.9933	455.9091	0.0022
1003090.6719	1000800.9375	826.9933	455.9091	0.0022
1002707.1719	1000910.0469	830.0415	455.9091	0.0022
1002707.1719	1001247.3438	830.0415	455.9091	0.0022
1003648.9375	1001413.1484	866.0882	455.9091	0.0022
1003648.9375	1001075.8516	866.0882	455.9091	0.0022
1003311.6406	1001075.8516	866.0882	455.9091	0.0022
1003311.6406	1001413.1484	866.0882	455.9091	0.0022
1003535.8281	1001338.2266	853.9816	455.9091	0.0022
1003535.8281	1001000.9297	853.9816	455.9091	0.0022
1003198.5391	1001000.9297	853.9816	455.9091	0.0022
1003198.5391	1001338.2266	853.9816	455.9091	0.0022
1003899.5156	1001505.2969	894.5464	455.9091	0.0022
1003899.5156	1001168.0000	894.5464	455.9091	0.0022
1003562.2266	1001168.0000	894.5464	455.9091	0.0022
1003562.2266	1001505.2969	894.5464	455.9091	0.0022
1003923.1875	1001508.5313	896.4286	455.9091	0.0022
1003923.1875	1001171.2344	896.4286	455.9091	0.0022
1003585.8984	1001171.2344	896.4286	455.9091	0.0022
1003585.8984	1001508.5313	896.4286	455.9091	0.0022
1003926.3672	1001489.6797	933.6617	455.9091	0.0022
1003926.3672	1001152.3906	933.6617	455.9091	0.0022
1003589.0781	1001152.3906	933.6617	455.9091	0.0022
1003589.0781	1001489.6797	933.6617	455.9091	0.0022
1003876.7266	1001457.6953	927.9183	455.9091	0.0022
1003876.7266	1001120.4063	927.9183	455.9091	0.0022
1003539.4297	1001120.4063	927.9183	455.9091	0.0022
1003539.4297	1001457.6953	927.9183	455.9091	0.0022
1003767.3906	1001385.8672	965.8685	455.9091	0.0022
1003767.3906	1001048.5781	965.8685	455.9091	0.0022

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THE DEPARTMENT OF DEFENSE FALLOUT PREDICTION SYSTEM

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OUTPUT PROCESSOR MODULE

PREPARED BY
TECHNICAL OPERATIONS RESEARCH,INC.
BURLINGTON, MASS.

**** SUMMARY OF INPUT IDENTIFIERS AND INITIAL CONDITIONS ****

**** OUTPUT PROCESSOR IDENTIFICATION ****
FIFTH LARGE SCALE TEST OF DELFIC. CHECK TOMPKINS. OPP

**** INITIAL CONDITIONS (FIREBALL) IDENTIFICATION ****
FIFTH LARGE SCALE TEST OF THE DELFIC MODEL. 1 FEB. 1967. INIT. COND.

**** CLOUD RISE IDENTIFICATION ****
FIFTH LARGE SCALE TEST OF THE DELFIC MODEL. 1 FEB. 1967. CLOUD RISE

**** PARTICLE SET EXPANSION IDENTIFICATION ****
FIFTH LARGE SCALE TEST OF THE DELFIC MODEL. 1 FEB. 1967. PSE

**** TRANSPORT IDENTIFICATION ****
FIFTH LARGE SCALE TEST OF THE DELFIC MODEL. 1 FEB. 1967. TRANSPOST

**** WIND IDENTIFICATION ****
THIS WIND FIELD USES THE FRENCHMAN FLATS AND ROAD 8 STATIONS. 1/30/67

**** TOPOGRAPHY IDENTIFICATION ****

**** OTHER INPUTS ****

**** THE CONTROL VARIABLE ARRAY, IC(J), WAS GIVEN THE FOLLOWING VALUES ****
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 1 0 0

THE FOLLOWING LOGICAL TAPES ARE AVAILABLE FOR SORTING.
1 3 4 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0

```
PRINTER DESCRIPTION  -  CHARACTERS PER INCH
   HORIZONTAL   10           VERTICAL    6

THE DIFFUSION CONSTANT IS       2.00000
```

```
**** OUTPUT PROCESSOR TASK    1 ****

GRID LIMITS AND INTERVALS
   XMIN           XMAX           YMIN           YMAX          DELTA X          DELTA Y
  993000.        1050000.       998000.        1015000.        1500.0           1500.0

THE CONTROL VARIABLE ARRAY, JC(J), HAS BEEN GIVEN THE FOLLOWING VALUES.
   1  2  3  4  5  6  7  8  9 10 11 12 13 14  0  0 17  0

GROUND ROUGHNESS FACTOR      0.500



REQUEST NUMBER    1

TYPE    2          T1 =        1.0          T2 =        2.0          MASCHN =   -0

MAPPED ON GRID INTERVALS  DGX =     1500.0   DGY=    1250.0

THE OUTPUT PRESENTATION IS A
TWO-LINE E FORMAT MAP

THE QUANTITY PRESENTED IS
DOSE RATE NORMALIZED TO TIME H+1 HOUR.
GROUND ZERO IS LOCATED AT  X =  1030000.0  , Y =  1000000.0
```

Y-COORDINATE SCALES FOR SIDES OF MAP

1014250.	1014250.
1013000.	1013000.
1011750.	1011750.
1010500.	1010500.
1009250.	1009250.
1008000.	1008000.
1006750.	1006750.
1005500.	1005500.
1004250.	1004250.
1003000.	1003000.
1001750.	1001750.
1000500.	1000500.
999250.	999250.

STRIP 1

******* ***** 1007000. ***** 1014500. *****

0	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.030	0.300	[illegible]	0.456	0.339	1.692	1.692	2.115	0.423
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	[illegible]	0.935	5.207	1.028	1.230	1.692	0.846	0.000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.333	0.030	0.000	0.000	0.000	0.030	1.393	4.542	5.897	4.166	0.807	0.403	0.000	0.000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.300	0.000	0.000	0.006	0.000	0.000	0.000	0.000	1.230	7.659	7.941	8.674	3.809	0.404	0.000	0.000	0.000
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.033	0.330	[illegible]	1.851	9.342	3.573	1.566	0.492	0.000	0.000	0.000	0.000
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.300	0.000	[illegible]	0.000	1.197	3.973	2.571	[illegible]	0.006	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.033	0.000	0.330	0.000	0.000	[illegible]	[illegible]	0.000	0.333	0.033	0.000	0.404	0.000	0.000	0.000	0.000
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.330	0.000	3.094	2.398	0.783	0.330	0.330	3.033	0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.300	0.000	0.002	[illegible]	1.559	4.062	0.003	0.330	0.330	0.333	0.000	0.000	0.003	0.000	0.000	0.000
0	0	0	0	0	1	1	1	0	0	0	0	3	0	0	0	0	0	0
0.000	0.000	0.330	0.000	0.334	2.541	1.264	3.655	4.223	0.000	0.330	0.330	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	[illegible]	0.771	1.609	1.286	1.576	0.441	0.000	0.003	0.330	0.330	0.330	0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	[illegible]	[illegible]	0.000	0.300	0.000	0.000	0.030	0.000	0.000	0.330	0.330	0.333	0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.030	0.333	0.000	0.000	0.000	0.000	0.000	0.000

******* ***** 1007000. ***** 1014500. *****

STRIP 8

0.43[illegible]	[illegible]	[illegible]	0.000	0.600	[illegible]	[illegible]	0.000	0.000	0.000	0.030	[illegible]	0.330	[illegible]	0.000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.000	[illegible]	0.300	0.000	[illegible]	0.000	[illegible]	0.000	0.000	[illegible]	0.330	[illegible]	[illegible]	0.000	0.060
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.000	[illegible]	[illegible]	0.000	[illegible]	0.000	[illegible]	0.000	0.000	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.000	[illegible]	[illegible]	0.000	[illegible]	[illegible]	[illegible]	0.000	[illegible]	[illegible]	0.030	[illegible]	[illegible]	[illegible]	0.000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.000	[illegible]	[illegible]	0.000	[illegible]	0.000	[illegible]	0.000	[illegible]	[illegible]	0.030	[illegible]	[illegible]	0.000	0.000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.000	[illegible]	[illegible]	0.000	[illegible]	[illegible]	[illegible]	[illegible]	0.000	0.000	0.030	[illegible]	[illegible]	[illegible]	0.000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.000	[illegible]	[illegible]	0.000	0.000	0.000	0.000	[illegible]	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000

******* ***** 1035500. ***** 10.3000. *****

APPENDIX

PRIMARY ARRAYS OF THE OUTPUT PROCESSOR

OMAP( )	One-dimensional map array used to store the part of the map currently being prepared for printing. Explicit index conversion is used to store and retrieve two-dimensional map data from this one-dimensional storage array.
X(J)	X coordinate of the Jth central particle description that is currently in memory. The arrays X, Y, T, PS, FMAS, and KTR are spoken of as the particle arrays.
Y(J)	Y coordinate, see X(J).
T(J)	Impact time associated with the Jth central particle description.
PS(J)	Particle diameter (microns) associated with the Jth central particle description.
FMAS(J)	Mass per unit area (mks system) associated with the Jth cloud subdivision at the time of its definition.
KTR(J)	Class indicator number for the Jth central particle description. KTR(J) = 0 indicates that the Jth particle description is not in use. KTR(J) > 0 indicates the number of the map zone or buffer zone into which the Jth central particle has fallen. See NP(K).
PSIZE(I)	Central particle size (microns, diameter) of the Ith size range of the tabulated particle size vs property arrays. The other arrays in this set are PACT, FMASS, and SV.
PACT(I)	Minimum particle size of the Ith particle size range. See PSIZE(I).
FMASS(I)	Fraction of the total particulate mass of the cloud that is represented by the Ith particle size range.
SV(I)	Surface to volume ratio of the Ith particle size range (as required by the Freiling radial distribution model).

NP(K)	Count of the number of central particles that are in the particle arrays and are known to belong in the Kth numbered zone or buffer zone of the desired map. These zones and buffer zones are numbered sequentially from left to right starting with the buffer zone just to the right of the first map zone to be printed (Zone 1 of Figure 1). Thus NP(K) for odd K are counts for buffer zones and for even K they are counts for interbuffer map zones.
CRID( )	Cloud Rise run identifier.
OPID( )	Output Processor run identifier.
PSEID( )	Cloud Rise-Transport Interface run identifier.
TOPID( )	Topography data identifier.
WID( )	Wind data identifier.
DETID( )	Initial Conditions run identifier.
TID( )	Transport run identifier.
IC( )	Control integer array.
IOT( )	An array containing the logical numbers of those tape units that are available for use by the Output Processor in sorting grounded particle descriptions.
ITT( )	Permanent copy of the original state of the array IOT( ).
JMAP( )	Array internal to subroutine MAP used to store temporarily a one-line group of integers for use in the printing of two-line E or F format maps.

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DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Technical Operations, Inc. Burlington, Mass.	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE
Department of Defense Land Fallout Prediction System
Volume VI - Output Processor

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Final Report

5. AUTHOR(S) (Last name, first name, initial)
T.W. Schwenke and P. Flusser

6. REPORT DATE 20 February 1967	7a. TOTAL NO. OF PAGES 118	7b. NO. OF REFS 0
8a. CONTRACT OR GRANT NO. DA 18-035-AMC-737(A) b. PROJECT AND TASK NO. DASA Subtask A7a/10.058 c. DOD ELEMENT d. DOD SUBELEMENT	9a. ORIGINATOR'S REPORT NUMBER(S) TO-B 66-48 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) DASA-1800-VI	

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY Defense Atomic Support Agency

13. ABSTRACT

The Output Processor Module of the Department of Defense Land Fallout Prediction System is described and instructions are given for its use. Working in close liaison with the Particle Activity Module (Volume V), the Output Processor converts the output of the Transport Module into a variety of displays in a directly contourable numerical (map) form by means of the off-line printer. It requires only two sets of input data in addition to the inputs called for by the Particle Activity Module: (1) a magnetic tape containing descriptions of sets of grounded fallout particles — an input from the Transport Module, and (2) card inputs by which the user may request any number of processing tasks to be carried out on the grounded fallout particle data. In each request any of sixteen distinct types of processing may be specified leading to the display of maps of any of the following quantities: (1) exposure rate "normalized" to H + 1 hour; (2) exposure rate at time H + T1 hours; (3) integrated exposure, H + T1 to infinity, accounting for time of arrival; (4) integrated exposure, H + T1 to H + T2, accounting for time of arrival; (5) fallout mass (per unit area); (6) fallout mass (per unit area) deposited between times H + T1 and H + T2; (7) integrated exposure, H + T1 to H + T2, assuming all particles have arrived by H + T1 hours; (8) same as 7 but integrated to infinity; (9) concentration of an individual mass chain

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14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Output Processor						
Fallout						
Nuclear Weapons Effects						
DELFIC						

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(curies/m^2); (10) time of arrival; (11) time of cessation; (12) smallest particle deposited; (13) largest particle deposited; (14) mass deposited by particles in the size range S1 to S2; (15) H + 1 hour "normalized" exposure rate resulting from particles in the size range S1 to S2; and (16) the number of cloud (model) subdivisions affecting each map grid point. The user is free to specify any limiting coordinates and scale factors for the map display that will be produced and can also cause the resulting map, or maps, to be recorded on magnetic tape for further processing.